GRADED WORK
IN
ARITHMETIC

FIFTH YEAR

BAIRD
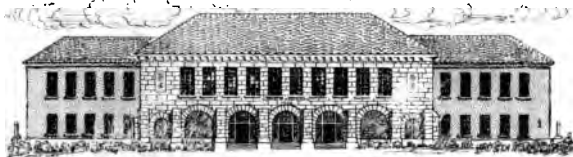
GRADED WORK

IN

ARITHMETIC

BY

S. W. BAIRD

PRINCIPAL FRANKLIN GRAMMAR SCHOOL, WILKESBARRE, PA.

FIFTH YEAR

NEW YORK ·:· CINCINNATI ·:· CHICAGO

AMERICAN BOOK COMPANY
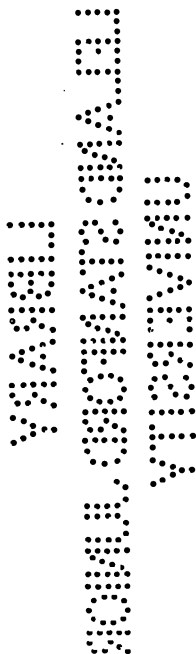
NOTE

THIS book begins with a review of the fourth year's
work, logically combined with a comprehensive treat-
ment of notation, numeration, addition, subtraction, mul-
tiplication, and division. More advanced work is given
in many of the subjects that were introduced in an ele-
mentary form in the preceding book; and factoring,
percentage, interest, and practical mensuration are here
presented for the first time.

The model solutions given for the written work are
so simple and clear that they can be understood without
difficulty by young pupils.

The method of treatment is largely inductive. The
pupil is led to see the reason for the various processes
and encouraged to formulate his own methods of opera-
tion.

CONTENTS

NOTATION AND NUMERATION

LESSON 1

Notation treats of the writing of numbers.

There are three ways of writing numbers.

   1. By words, as *one, two, three, four*, etc.
   2. By figures, called the *Arabic method*.
   3. By letters, called the *Roman method*.

In the **Arabic System** of notation *ten* characters called figures are employed to represent numbers. These characters are: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

Numeration treats of the reading of numbers, when expressed by figures or other characters.

For convenience in reading, when numbers are expressed by more than three figures, they are generally separated by commas into periods, or groups, of three figures each, as shown in the following table:

NUMERATION TABLE

INTEGERS						DECIMALS	
HUNDRED-QUADRILLIONS / TEN-QUADRILLIONS / QUADRILLIONS	HUNDRED-TRILLIONS / TEN-TRILLIONS / TRILLIONS	HUNDRED-BILLIONS / TEN-BILLIONS / BILLIONS	HUNDRED-MILLIONS / TEN-MILLIONS / MILLIONS	HUNDRED-THOUSANDS / TEN-THOUSANDS / THOUSANDS	HUNDREDS / TENS / UNITS	TENTHS / HUNDREDTHS / THOUSANDTHS	TEN-THOUSANDTHS / HUNDRED-THOUSANDTHS / MILLIONTHS
4 2 6,	4 2 6,	4 2 6,	4 2 6,	4 2 6,	4 2 6 .	4 2 6,	4 2 6
6. QUADRILLIONS' PERIOD	5. TRILLIONS' PERIOD	4. BILLIONS' PERIOD	3. MILLIONS' PERIOD	2. THOUSANDS' PERIOD	1. UNITS' PERIOD	1. THOUSANDTHS' PERIOD	2. MILLIONTHS' PERIOD

5

Read:

1. 86	7. 8641	13. 580.64	19. 46.011
2. 8.6	8. 864.	14. 5806.4	20. 963.821
3. .86	9. 86.4	15. 5.8064	21. $333.33\frac{1}{3}$
4. 125	10. 8.641	16. 58.064	22. $666.6\frac{2}{3}$
5. 12.5	11. .8641	17. 902.462	23. $846.87\frac{1}{2}$
6. .125	12. 58064	18. 3.864216	24. $13846.37\frac{1}{2}$

LESSON 2

Write in words:

1. 95	6. 3.46	11. .4635	16. 386.04
2. 9.5	7. .346	12. 30864	17. 389.243
3. .95	8. 463.5	13. 308.64	18. $726.33\frac{1}{3}$
4. 346	9. 46.35	14. 3.0864	19. $92064.37\frac{1}{2}$
5. 34.6	10. 4.635	15. 586.038	20. $653821.66\frac{2}{3}$

Write in figures:

21. Eighty-four and three tenths.

22. Four hundred forty and seven hundredths.

23. Seven hundred forty-two and thirty-six hundredths.

24. Six thousand three hundred twenty-five and twenty-three hundredths.

25. Twenty-nine thousand four hundred twenty-one and one tenth.

26. Six hundred forty-eight thousand two hundred twenty-three and twenty-four thousandths.

27. Sixteen million six hundred four thousand seventy-six and seventy-two thousandths.

28. Thirty million thirty thousand thirty and four hundredths.

29. Eight billion thirty-six million one hundred thousand three hundred nineteen and eight hundred twenty-four ten-thousandths.

LESSON 3

The **Roman Notation** employs seven letters of the Roman alphabet to represent numbers.

I V X L C D M, letters employed.
1 5 10 50 100 500 1000, values.

Other numbers are represented by repeating or combining these letters according to certain principles.

PRINCIPLES

1. *Every time a letter is repeated, the number represented by it is repeated.*

Thus, II, 2; XX, 20; CCC, 300.

2. *By writing a letter before one of greater value, the difference of their values is represented.*

Thus, IV, 4; IX, 9; XL, 40.

3. *By writing a letter after one of greater value, the sum of their values is represented.*

Thus, VI, 6; XI, 11; XV, 15.

4. *When a letter is written between two letters each of greater value, it is combined with the one following it, according to Principle 2.*

Thus, XIV, 14; CIX, 109; DXL, 540.

5. *The value of an expression is increased a thousand-fold by placing a dash over it.*

Thus, $\overline{V}$, 5000; $\overline{X}$, 10,000; $\overline{XV}$, 15,000.

Read :
<div>

1. II, VI, IX
2. XI, XX, XL
3. LI, XC, CX
4. CCC
5. CCIX

6. CCCXC
7. DC
8. DXX
9. DCC
10. MC

11. CM
12. MCMI
13. $\overline{\text{XI}}$
14. $\overline{\text{XL}}$
15. $\overline{\text{M}}$

</div>

LESSON 4

Write in Roman notation :

1. 5
2. 7
3. 9
4. 11
5. 12

6. 14
7. 16
8. 19
9. 24
10. 29

11. 37
12. 49
13. 67
14. 92
15. 104

16. 190
17. 256
18. 378
19. 400
20. 769

21. 1642
22. 1492
23. 1520
24. 1776
25. 1900

Write in figures :

26. XXI
27. IX
28. XXIX
29. XL
30. X

31. CV
32. LXX
33. CXL
34. DXX
35. MCD

36. MDX
37. MCCC
38. MDXC
39. MDCCCXC
40. MMXL

41. $\overline{\text{X}}$
42. $\overline{\text{CM}}$
43. $\overline{\text{DC}}$
44. $\overline{\text{DXL}}$
45. $\overline{\text{CMIII}}$

Write and express in figures the numbers represented by Roman letters :

46. Virginia was settled in MDCVII.

47. Pilgrims landed in Massachusetts in MDCXX.

48. The Dutch began to colonize New Netherland in MDCXIV.

49. The Swedes made a settlement on the Delaware in MDCXXXVIII.

50. A settlement was made in Pennsylvania in the year MDCLXXXI.

LESSON 5

United States Money is the lawful money of the United States. It consists of two kinds, specie or coin, and paper money.

In writing United States money, dollars are separated from cents by a small dot (.) called the **Decimal Point.** All figures to the left of the point denote dollars; all figures to the right, parts of the dollar. The first two places to the right of the point represent cents; the third, mills; the fourth, tenths of a mill.

The sign for dollars is $.

Read the following:

1. $3.87	6. $2.843	11. $806.906
2. $5.06	7. $32.065	12. $8462.005
3. $9.60	8. $845.31	13. $3693.841
4. $20.03	9. $764.375	14. $6004.006
5. $49.89	10. $100.104	15. $389427.651

Express by figures:

16. Four dollars and seventy-five cents.

17. Twenty-eight dollars and thirty-seven cents.

18. Two hundred forty-nine dollars and fourteen cents.

19. Seven hundred sixty dollars, eighty-five cents and four mills.

20. Two thousand twenty-nine dollars and seventy-two cents.

21. Seventy-eight thousand four hundred dollars and ten cents.

22. Twenty-eight dollars and eight mills.

23. Fifteen dollars, fifteen cents and seven mills.

24. One hundred fifty-three thousand four hundred sixty-three dollars, forty-two cents and nine mills.

LESSON 6

1. What is notation?

2. State the three ways of writing numbers.

3. What is the Arabic System of notation?

4. Of what does numeration treat?

5. When a figure stands alone what does it **denote**? Ans. units.   What does the word unit mean?

6. What does a figure placed at the left of units denote?

7. In 66, how many units does the figure at the right express?   How many units does the second figure express?   The second 6 expresses how many times as many units as the first 6?

8. 60 units are how many times 6 units?

9. In 666, what does the first figure at the left express? It expresses how many times as many tens as the second 6? How many 10's are 300?   600?   How many units are 30 tens?

10. In 6.6, the figure at the right of the decimal point expresses what part of the value of the figure at the left of the point?   6 equals how many times .6?

11. How can you make 6 stand for *sixty?*   How can you make it stand for *six tenths? Six hundredths?*

12. Name the smallest whole number that can be written with three figures.   The largest.

ADDITION

Addition is an operation by which two or more numbers are combined into one number, called their **Sum** or **Amount.**

Only similar numbers can be added. Units must be added to units, tens to tens, dollars to dollars, pounds to pounds, etc.

1. How many are 6 hats and 7 hats?

2. How many are 3 eighths and 2 eighths? $\frac{3}{8} + \frac{2}{8} = ?$

3. How many are 3 tenths and 6 tenths?

$$\tfrac{3}{10} + \tfrac{6}{10} = .3 + .6$$

4. A man paid $18½ for a coat and $3 for a hat. How much did both cost him?

5. How many feet is it around a table 6½ feet long and 3¼ feet wide?

6. A room is 12½ feet long and 10 feet wide. What is the distance around the room?

7. A grocer bought from one farmer 13½ pounds of butter and from another 11¼ pounds. How many pounds did he buy from both?

8. If 4¾ yards of cloth are needed for a coat, and 2½ yards for a vest, how many yards are needed for both?

Add:

9.	10.	11.	12.	13.
$4,785	$3,714,110	$12.36	$4.795	$94.01
45,651	205,009	17.04	9.368	36.10
728,198	8,196,573	31.36	12.06	81.015
469,873	84,954	19.07	7.316	39.901

14.	**15.**		**16.**	**17.**		**18.**
$\$12\frac{1}{2} =$	$\$12.50$		$\$4\frac{1}{4} =$	$\$4.25$		$3\frac{1}{5}$
$6\frac{1}{4} =$	6.25		$9\frac{1}{2} =$	9.50		$8\frac{2}{5}$
$18\frac{3}{4} =$	18.75		$8\frac{1}{3} =$	$8.33\frac{1}{3}$		$16\frac{3}{5}$

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	
19.	$2.5 +$	$3.02 +$	$6.7 +$	$9.03 +$	$2.12 +$	41.08	$=$
20.	$4.7 +$	$7.13 +$	$8.9 +$	$6.015 +$	$7.01 +$	3.013	$=$
21.	$9.5 +$	$3.08 +$	$6.02 +$	$4.06 +$	$3.09 +$	4.16	$=$
	$+$	$+$	$+$	$+$	$+$		$=$

22. Add three hundred ninety-five, one thousand seventy-four, eleven thousand four hundred eighty-nine, and thirty-two thousand three hundred seventy.

23. Add three million five hundred seventeen thousand sixty-five, seven hundred forty-six thousand seven hundred, seventeen million twelve thousand twenty-one, fifty million thirteen thousand sixteen.

24. $40.1 + 927 + 45.16 + 2079 + 180.64.$

25. $29.64 + 384.1 + 1684.24 + 96438.9.$

26. $38.64 + 304.08 + .38 + 9.683 + 900.46.$

SUBTRACTION

LESSON 8

Subtraction is an operation by which the difference between two numbers is found.

Only like numbers can be subtracted. Units must be taken from units, tens from tens, hundreds from hundreds, dollars from dollars, etc.

The number from which another is taken is called the **Minuend.**

The number taken from the minuend is called the **Subtrahend.**

The number that is left after the subtrahend is taken from the minuend is called the **Difference** or **Remainder.**

1. John had 24 marbles and gave his brother 10. How many had he left?

2. A boy picked $8\frac{1}{2}$ quarts of berries and sold $3\frac{1}{2}$ quarts. How many quarts remained?

3. A tailor bought a piece of cloth containing 26 yards. After he had used $12\frac{1}{2}$ yards, how many yards were left?

4. A grocer bought 16 dozen eggs and sold $5\frac{1}{2}$ dozen. How many dozen were left?

5. $7 - 2\frac{1}{2} =$

6. $5 - 3\frac{1}{2} =$

7. $8\frac{1}{2} - 2\frac{3}{8} =$

8. $7 - 2\frac{1}{4} =$

9. $7\frac{3}{4} - 2\frac{1}{8} =$

10. $\frac{9}{10} - \frac{3}{10} =$

11. $.8 - .2 =$

12. $2.5 - 1.3 =$

13. $8.2 - .6 =$

14. $\frac{2}{5} - \frac{3}{10} =$

15. $9\frac{2}{3} - \frac{3}{4} =$

16. $10\frac{5}{6} - 7\frac{1}{2} =$

13

LESSON 9

Subtract:

1.	2.	3.	4.	5.
4638	8756	405067	$405.65	940.067
3769	4868	376989	278.99	737.698

6. $24 - 8\frac{2}{3} =$

7. $39 - 12\frac{1}{4} =$

8. $16\frac{3}{4} - 7\frac{1}{2} =$

9. $39\frac{2}{3} - 24\frac{1}{6} =$

10. $\$6.50 - \$4.33\frac{1}{3} =$

11. $5.25 - 3.06 =$

12. $86.01 - 72.62\frac{1}{2} =$

13. $520 - 176.3 =$

14. $900 - 333.42 =$

15. $4006 - .064 =$

16. A clerk earns $56 a month. How much has he left after paying expenses amounting to $25.63?

17. A man bought $341\frac{2}{3}$ acres of land and sold $80\frac{3}{4}$ acres. How many acres had he remaining?

18. A miller bought corn at 52¢ a bushel and sold it at $51\frac{7}{8}$¢ a bushel. How much did he lose per bushel?

19. A lady purchased goods amounting to $\$7.37\frac{1}{2}$. How much change should she receive from $10?

20. A farmer has 426 rods of fence to build. If he hires a man to build $241\frac{3}{8}$ rods, how many rods are still left to build?

21. A man has a field of $28\frac{7}{10}$ acres to plow. After he has plowed $18\frac{4}{5}$ acres, how many acres are left to plow?

22. How many feet must be added to $36\frac{3}{4}$ feet to make $49\frac{11}{12}$ feet?

23. The minuend is 346.32 and the subtrahend is $147\frac{9}{10}$. Find the difference.

24. The minuend is 253.06 and the subtrahend is $46\frac{4}{5}$ less than the minuend. Find the subtrahend.

ADDITION AND SUBTRACTION

LESSON 10

1. $2 + \frac{1}{2} - 1 =$ 6. $6\frac{1}{4} - \frac{3}{4} + 7 =$ 11. $6 + \frac{2}{3} - \frac{1}{6} =$

2. $5 - \frac{1}{2} + 1\frac{1}{2} =$ 7. $7\frac{1}{2} + \frac{1}{4} - \frac{3}{4} =$ 12. $7 - \frac{1}{2} + \frac{2}{3} =$

3. $2\frac{1}{3} + 2\frac{2}{3} - 3 =$ 8. $7\frac{1}{2} - 5 + 2\frac{1}{2} =$ 13. $5 + 3\frac{1}{2} - \frac{1}{3} =$

4. $4 + 7 - \frac{2}{3} =$ 9. $12 - 9\frac{2}{3} + \frac{1}{3} =$ 14. $3 - \frac{7}{8} + \frac{1}{4} =$

5. $5 - \frac{2}{3} + 6 =$ 10. $7 - 3\frac{7}{8} + 2 =$ 15. $\frac{3}{4} + \frac{5}{6} - 1\frac{7}{12} =$

16. A boy had 18 marbles. He lost 11 of them and won 12. How many had he then?

17. A butcher sold $2\frac{3}{4}$ pounds of meat to one person, and $4\frac{2}{3}$ pounds to another. How much did he sell to both?·

18. $9\frac{1}{2} + 13\frac{1}{4} - 16\frac{3}{4} =$ 21. $28\frac{3}{4} - 14\frac{1}{2} + 7\frac{2}{3} =$

19. $16\frac{3}{4} - 8\frac{7}{12} + 6\frac{2}{3} =$ 22. $\frac{2}{3} + \frac{3}{4} - \frac{5}{6} + 2\frac{1}{3} =$

20. $9.5 + 3.7 - 4.8 =$ 23. $24.3 - 7\frac{4}{5} + 6.25 + 5\frac{2}{5} =$

24. From a box containing 38 bushels of oats were sold $4\frac{2}{3}$ bushels, $7\frac{3}{4}$ bushels, $8\frac{5}{6}$ bushels. How many bushels remained?

25. Four bees in succession visited a clover blossom. The first carried away $\frac{1}{3}$ of the pollen, the second, $\frac{1}{4}$, and the third, $\frac{2}{6}$. How much remained for the fourth?

26. A farmer cut $24\frac{3}{4}$ tons of hay from one field and $2\frac{1}{3}$ tons less from another. How many tons did he cut from both?

LESSON 9

Subtract:

1.	2.	3.	4.	5.
4638	8756	405067	$405.65	940.067
3769	4868	376989	278.99	737.698

6. $24 - 8\frac{2}{3} =$

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10. $\$6.50 - \$4.33\frac{1}{3} =$

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19. A lady purchased goods amounting to $7.37\frac{1}{2}$. How much change should she receive from $10?

20. A farmer has 426 rods of fence to build. If he hires a man to build $241\frac{2}{3}$ rods, how many rods are still left to build?

21. A man has a field of $28\frac{7}{10}$ acres to plow. After he has plowed $18\frac{4}{5}$ acres, how many acres are left to plow?

22. How many feet must be added to $36\frac{3}{4}$ feet to make $49\frac{11}{12}$ feet?

23. The minuend is 346.32 and the subtrahend is $147\frac{9}{10}$. Find the difference.

24. The minuend is 253.06 and the subtrahend is $46\frac{4}{5}$ less than the minuend. Find the subtrahend.

LESSON 12

Multiply :

1.	2.	3.	4.	5.
9525	93415	840007	$ 2125.96	3142.076
489	2104	6232	70.48	2.35

6. $3\frac{1}{2} \times 8 =$ 11. $9.2 \times 8 \quad =$ 16. $\$17.65 \times 7 \ =$

7. $\frac{3}{8} \times 16 =$ 12. $.04 \times 6 \quad =$ 17. $\$33.42 \times 8 \ =$

8. $5\frac{1}{2} \times 12 =$ 13. $7.8 \times 9 \quad =$ 18. $\$75.06 \times 9 \ =$

9. $8\frac{2}{3} \times 9 =$ 14. $25 \times 2.5 \quad =$ 19. $42.62\frac{1}{2} \times 6 \ =$

10. $\frac{8}{9} \times 18 =$ 15. $60 \times .12\frac{1}{2} =$ 20. $.62\frac{1}{2} \times 60 =$

21. How many pounds in $25\frac{1}{2}$ tons of hay ?

22. How many hours in January ? In February, 1901 ?

23. Find the cost of 23.7 tons of plaster at $7.25 per ton.

24. How much will 8 pairs of skates cost at $\$1\frac{7}{8}$ a pair ?

25. At $12\frac{1}{2}$ ¢ a peck, how much will 5 bushels of apples cost ?

26. How many square inches are there in one pane of glass in your schoolroom window ? How many square inches in all the panes in your schoolroom ?

27. How many quarts are there in 8 bu. 2 pk. 3 qt. ?

28. Find the cost of $4\frac{3}{8}$ quires of paper at $\frac{1}{2}$ ¢ per sheet.

29. Change 4 sq. rd. 16 sq. yd. to square yards.

30. Multiply 21 yd. 2 ft. 7 in. by 6.

31. Brussels carpet is $2\frac{1}{4}$ feet wide. How many square feet are there in a piece 24 feet long ?

MULTIPLICATION

LESSON 11

Multiplication is a short operation of finding the sum of as many expressions of one number as there are units in another number.

```
9
9
9
9
─
36
```

For example, if we wish to find the sum of four 9's by addition, we express 9 four times, as in the operation at the left, and add the column, finding the sum 36.

But in multiplication, such facts as 4 times 9 are 36, are committed to memory by means of a *multiplication table*, and employed in finding the result with larger numbers.

```
9
4
─
36
```

The **Multiplicand** is the number which is to be taken a certain number of times.

The **Multiplier** is the number which shows how many times the multiplicand is to be taken.

The **Product** is the result obtained by taking the multiplicand a certain number of times.

1. There are 60 minutes in one hour. How many minutes are there in 6 hours?

2. If a machinist earns $3¼ a day, how much does he earn in three days? In a week?

3. If 5 men can do a piece of work in $4\frac{1}{2}$ days, how long will it take one man to do it?

4. How many feet in 2 rods? In $3\frac{1}{2}$ yards?

5. How much will 4 lb. 8 oz. of sugar cost at 6 ¢ per lb.?

6. How many square inches are there in the top of a table 6 feet long and $2\frac{2}{3}$ feet wide?

LESSON 12

Multiply :

1.	2.	3.	4.	5.
9525	93415	840007	$ 2125.96	3142.076
489	2104	6232	70.48	2.35

6. $3\frac{1}{2} \times 8 =$ **11.** $9.2 \times 8 =$ **16.** $\$17.65 \times 7 =$

7. $\frac{3}{8} \times 16 =$ **12.** $.04 \times 6 =$ **17.** $\$33.42 \times 8 =$

8. $5\frac{1}{2} \times 12 =$ **13.** $7.8 \times 9 =$ **18.** $\$75.06 \times 9 =$

9. $8\frac{2}{3} \times 9 =$ **14.** $25 \times 2.5 =$ **19.** $42.62\frac{1}{2} \times 6 =$

10. $\frac{8}{9} \times 18 =$ **15.** $60 \times .12\frac{1}{2} =$ **20.** $.62\frac{1}{2} \times 60 =$

21. How many pounds in $25\frac{1}{2}$ tons of hay ?

22. How many hours in January ? In February, 1901 ?

23. Find the cost of 23.7 tons of plaster at $7.25 per ton.

24. How much will 8 pairs of skates cost at $1\frac{7}{8}$ a pair ?

25. At $12\frac{1}{2}$ ¢ a peck, how much will 5 bushels of apples cost ?

26. How many square inches are there in one pane of glass in your schoolroom window ? How many square inches in all the panes in your schoolroom ?

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29. Change 4 sq. rd. 16 sq. yd. to square yards.

30. Multiply 21 yd. 2 ft. 7 in. by 6.

31. Brussels carpet is $2\frac{1}{4}$ feet wide. How many square feet are there in a piece 24 feet long ?

DIVISION

Division is the operation of finding how many times one number is contained in another, or of dividing a number into equal parts.

The **Dividend** is the number to be divided.

The **Divisor** is the number by which we divide.

The **Quotient** shows how many times the dividend contains the divisor, or the value of one of the equal parts into which the dividend has been divided.

1. 4 oranges $\div 2 =$? $\frac{4}{5}$ of an orange $\div 2 =$? If 2 primers cost 80 ¢, how much will one cost?

2. If 3 spellers cost $\$\frac{9}{10}$, how much will one cost?

3. If 4 books are worth $\$\frac{12}{25}$, how much is one worth?

4. When potatoes are worth $\$\frac{1}{4}$ a bushel, how many bushels can you get for $\$1$? $\$2\frac{1}{4}$? $\$3\frac{1}{2}$?

5. $1 \div \frac{1}{4} =$? $1 \div \frac{2}{4} =$? $2\frac{1}{4} \div \frac{1}{4} =$? $3\frac{1}{2} \div \frac{1}{4} =$? $5 \div \frac{1}{4} =$?

6. Mr. Stout burned 3.6 tons of coal in 6 weeks. How much was that per week?

7. If a man burnt $\frac{2}{3}$ of 9 tons of coal in 3 months, how much was that per month?

8. Among how many children can you divide 12 apples if you give to each child $\frac{1}{4}$ of an apple?

9. If a man can walk 19.8 miles in 6 hours, how far can he walk in one hour?

18

LESSON 14

1. $338 \div 13 =$
2. $980 \div 14 =$
3. $837789 \div 97 =$
4. $734096 \div 172 =$
5. $3675 \div 15 =$

6. $\$3675 \div 15 =$
7. $\$36.75 \div 15 =$
8. $\$3675 \div \$15 =$
9. $\$3675 \div \$.15 =$
10. $\$36.75 \div \$.15 =$

11. $46\frac{3}{4} \div \frac{1}{4} =$
12. $48\frac{1}{2} \div \frac{1}{4} =$
13. $34\frac{1}{2} \div \frac{1}{8} =$
14. $66\frac{1}{4} \div \frac{1}{8} =$
15. $28\frac{2}{3} \div \frac{1}{3} =$

16. At $\$\frac{1}{4}$ a bushel, how many bushels of onions can you buy for $\$25$? For $\$30$? For $\$35\frac{3}{4}$?

17. If it requires $3\frac{1}{2}$ yards of cloth to make a coat, how many coats can be made from $31\frac{1}{2}$ yards?

18. At $60\cancel{c}$ a pound, how many pounds of tea can be bought for $\$57.60$?

19. How many rods, yards, etc., in 1856 inches?

20. If .75 of a ton of hay cost $\$12.30$, find the cost of a ton.

21. How many dresses containing 12.5 yards each can be made from 150 yards of silk?

22. The area of a given rectangle is 810 square feet. If its length is 40 ft. 6 in., what is its width?

23. At $\$\frac{3}{4}$ a yard, how many yards of cashmere can be bought for $\$126$?

24. How many quires are there in 23,040 sheets of paper? How many reams?

25. Divide 36 bu. 2 pk. 2 qt. by 5.

26. How many tons are there in 32,600 pounds of iron?

27. If a passenger train went 383.56 miles in 8.6 hours, what was the rate per hour?

MISCELLANEOUS WORK

1. If a man can lay a sidewalk in 8 days, in what time can 2 men lay it?

2. If a man can dig a ditch in 12 days, in what time can 4 men dig it? In what time can 6 men dig it?

3. If a horse can eat a quantity of hay in 10 weeks, how long will an equal quantity last 5 horses?

4. How many quarts are there in a gallon? 2 quarts are what part of a gallon?

5. If a gallon of molasses costs 40¢, how much will 2 quarts cost?

6. How many pints are there in a gallon? 1 pint is what part of a gallon? 3 pints? 5 pints?

7. How much are 4 pints of cream worth at 80¢ a gallon? 3 pints? 5 pints?

8. If $\frac{1}{2}$ of a yard of calico is worth 4¢, how much are 8 yards worth?

9. A boy spent $\frac{3}{4}$ of an hour preparing his lesson in arithmetic. How many minutes did he spend?

10. If he spent $\frac{1}{2}$ of an hour preparing his lesson in grammar, how many hours did he spend at both lessons?

11. 8 tops cost how many times as much as 2 tops?

12. If 2 cups cost 11¢, how much will 8 cost?

13. Express in cents the following fractions of \$1: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{10}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{1}{5}$, $\frac{4}{5}$, $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$.

LESSON 16

1. How many minutes are there in 365 days 5 hours 48.5 minutes?

Find the cost of:

2. 3 doz. collars at 2 for 25¢.

3. 25 yd. of cloth at $⅞.

4. 6 lb. coffee at 2 lb. for 65¢.

5. 24½ yd. silk at $1.25.

6. 30 gal. ice cream at 2 qt. for 65¢.

7. 32¼ lb. butter at 26¢.

8. 28 picture frames at $⅝.

9. 12¾ lb. tea at 75¢.

10. A merchant bought cloth at $⅞ a yard, and sold it at 95¢ a yard. How much was his gain on 35 yards?

11. If 9 men do a piece of work in 42 days, how long will it take 14 men to do the same work?

12. If ⅞ of an acre of land is worth $35, how much is one acre worth? 3¾ acres?

13. How much will it cost to lay a flagstone sidewalk 50 feet long and 8 feet wide at $⅛ per square foot.

Make out in proper form the following bill:

14. May 1, 1900, Mr. Thomas Snyder bought of W. R. Toomb, 4¾ lb. butter @ 32¢; 1 ham (14 lb.) at 11¼¢; 2¼ yd. of lace @ 60¢; 1½ doz. oranges at 35¢; 24 bars soap @ 6¼¢; 2 doz. bananas @ 15¢; 3¾ lb. cheese at 16¢; 5 lb. coffee @ 35¢; 20 lb. granulated sugar @ 6¼¢.

15. If 1 lb. 11 oz. of coffee cost 54¢, find the cost of 8 lb. 15 oz. at the same rate.

16. Write in Arabic notation : MCCXL, $\overline{\text{M}}$, MDIV, MDCCCXC, $\overline{\text{XI}}$, MCMI, MMLX.

17. Express in Roman notation: 99, 999, 1099, 1999, 9999, 10500, 669.

LESSON 17

1. In one bin there are ⅔ of 21 bushels of grain, and in another bin ¾ of 16 bushels. How many bushels are there in both bins together ?

2. What is the Roman method of notation ?

3. What is United States money ? Name the gold coins. Name the silver coins.

4. How much will 11 eggs cost at 18¢ a dozen ?

5. Define *minuend, subtrahend, remainder.*

6. The minuend *minus* the remainder equals what ?

7. The subtrahend *plus* the remainder equals what ?

8. Illustrate by examples your answers to the sixth and seventh questions.

9. If ¼ of a pole stands in the mud and ⅓ in the water, what part of the pole is in the air ?

10. What is the length of the pole if the length in the air is 15 feet?

11. If you have .8 of a quantity, how much more is needed to make ⅔ of the quantity ?

12. A conductor collected 95 five-cent fares. Express the amount collected in dollars and cents.

13. Show that multiplication is a short method of getting the sum of equal numbers.

14. A lady bought two articles costing $2¾ and $1⅔ respectively. How much less than $5 did they both cost her?

15. Tell the meaning of the words, *multiplicand, multiplier, product*.

16. If ⅖ of my money is $13, how much is ⅕ of it?

17. What are ¾ of 12? 16? 24? 32? 20? 40?

18. If ⅓ of a ton of straw is worth $4⅔, how much are 500 pounds worth?

LESSON 18

1. From a piece of cloth containing 34½ yards there were sold at one time 10¾ yards, and at another time 8⅔ yards. How many yards were left?

2. If 1¾ pecks of nuts cost $1.26, how much will one quart cost?

3. From ⅓ of 100 take 16⅔.

4. How many square yards of carpet will be needed to cover the floor of a room 18 feet long and 15 feet wide?

5. Two men traveled in opposite directions. One traveled 3¾ miles an hour, and the other 4⅚ miles. How far apart were they at the end of 2 hours?

6. Find the cost of 12 barrels of flour if ⅔ of a barrel cost $3.60.

7. At $31.25 each how many cows will cost $906.25?

8. The base of a triangular flower bed is 36 feet and the altitude is 40 feet. Find the area.

9. How many feet of fence will be necessary to fence a rectangular lot $125\frac{1}{2}$ feet long and $66\frac{2}{3}$ feet wide?

10. James and John travel in the same direction, James at the rate of $3\frac{1}{2}$ miles an hour, and John $5\frac{1}{2}$ miles an hour. In how many hours will John be 7 miles ahead of James?

11. $\frac{1}{2} + \frac{3}{4} + \frac{2}{3} + \frac{5}{6} =$

12. $\frac{3}{4} + \frac{1}{2} + \frac{5}{8} + \frac{1}{4} =$

13. $\frac{1}{3} + \frac{3}{4} + \frac{3}{8} + \frac{2}{3} =$

14. $\frac{2}{3} + \frac{7}{12} + \frac{3}{4} + \frac{1}{2} =$

15. $\frac{1}{3} + \frac{2}{9} + \frac{2}{3} + \frac{5}{9} =$

16. $\frac{1}{2} + \frac{2}{5} + \frac{3}{10} + \frac{4}{5} =$

17. $\frac{3}{4} + \frac{2}{3} + \frac{5}{6} + \frac{7}{12} =$

18. $\frac{2}{5} + .6 + \frac{7}{10} + .4 =$

19. $\frac{3}{4} + \frac{1}{2} + \frac{7}{8} + 1 =$

20. $2 + .6 + \frac{3}{10} + 2.5 =$

21. $1\frac{1}{9} + \frac{2}{3} + 2 + 1\frac{5}{9} =$

22. $1\frac{1}{4} + \frac{5}{12} + \frac{5}{6} + \frac{2}{3} =$

LESSON 19

1. $2 + 3.5 =$

2. $4.3 + 2.6 =$

3. $3.7 + .5 =$

4. $2.9 + 1.6 =$

5. $\frac{8}{10} - .3 =$

6. $.7 - \frac{2}{5} =$

7. $8.4 - 1.7 =$

8. $7.25 - .09 =$

9. $2 \times \frac{3}{10} =$

10. $2 \times .3 =$

11. $9 \times .7 =$

12. $1.6 \times 5 =$

13. $\frac{2}{3}$ of the distance between two buildings is 16 yards. What is the distance in feet?

14. A boy picked 8 quarts of berries and sold all except $1\frac{1}{2}$ quarts at $4\cancel{c}$ a pint. How much did he receive for what he sold?

15. How many peaches can you buy for $\$\frac{1}{5}$ at the rate of 3 peaches for $5\cancel{c}$?

16. How many hundredths equal $.5$? $.7$? $.9$?

17. $.8 \div 4 = \quad .8 \div .4 = \quad .25 \div 5 = \quad .25 \div .05 =$

18. $\$.42 \div \$.14 = \quad .42 \div .14 = \quad \$.42 \div 14 = \quad \frac{1}{14}$ of $\$.42 =$

19. At $ .14 a yard, how many yards of ribbon can you buy for $ .56 ?   If 14 boxes of matches cost $ .56, find the cost of one box.

20. At 5 ⊄ each, how many pencils can you buy for $1.5 ?

21. If .6 of a yard of silk cost .6 of a dollar, how much will 2.6 yards cost ?

22. $\frac{1}{10}$ of 5 =   **26.** .1 × 10 =   **30.** .5 ÷ .05 =

23. .1 × 5 =   **27.** 1.3 ÷ .1 =   **31.** .64 ÷ 4 =

24. .1 × 8 =   **28.** 2.6 ÷ .2 =   **32.** 37.2 ÷ 3 =

25. .1 of 9 =   **29.** $\frac{9}{10}$ ÷ .3 =   **33.** .96 ÷ 8 =

34. Define *division, dividend, divisor, quotient*.

35. If $ 24 is $\frac{3}{4}$ of my money, how much is $\frac{5}{8}$ of it ?

36. A farmer fed 12 tons of hay to his cattle in 6 weeks. At the same rate, how many tons will he feed in 11 weeks ?

LESSON 20

1. If it takes $8\frac{3}{4}$ yards to make a dress, how many yards will be needed to make a dozen dresses ?

2. At $$\frac{5}{8}$ a yard, how much will 16 yards of lace cost ?

3. Change to thirds : $24\frac{2}{3}$, $65\frac{1}{3}$, $93\frac{2}{3}$, $128\frac{1}{3}$.

4. Change to eighths : $33\frac{1}{2}$, $45\frac{3}{8}$, $68\frac{5}{8}$, $96\frac{7}{8}$.

5. Change to whole or mixed numbers : $\frac{42}{3}$, $\frac{86}{2}$, $\frac{144}{4}$, $\frac{306}{6}$, $\frac{128}{8}$, $\frac{441}{9}$, $\frac{528}{12}$.

6. If a man earns $$2\frac{1}{2}$ a day and pays $$\frac{3}{4}$ a day for his board, how many days will it take him to save $280 ?

7. Find the sum of 38 and 29 hundredths ; 8 thousandths ; 27 hundredths ; 9 and 9 hundredths ; 39 and 28 thousandths.

8. $21.4 \times 3.2 =$ **11.** $69.12 \div 16 =$ **14.** $235.62 \div 6.3 =$

9. $23.6 \times 4.3 =$ **12.** $73.78 \div 17 =$ **15.** $223.155 \div 9.5 =$

10. $16.9 \times .7 =$ **13.** $210.56 \div 28 =$ **16.** $917.28 \div 7.2 =$

17. How many square yards in the four walls of a room 18 feet long, 15 feet wide, and 9 feet high?

18. Change 2880 rods to miles. To yards. To feet.

19. Find the number of days from Oct. 16, 1899, to April 1, 1900.

20. Find the number of sods 18 inches by 10 inches that will be needed to cover a lawn 12 feet long and 10 feet wide.

Find the cost of:

21. 36,400 lb. of hay at $14.50 per ton.

22. 9500 shingles at $3.75 per M.

23. 3460 cabbages at $3 per C.

24. 3846 lb. of coal at $3 per ton (2000 lb.).

25. 4620 ft. of boards at $36 per M.

26. 4860 lb. of wheat at 75¢ per bushel (60 lb.).

27. If $\frac{2}{3}$ of an acre of land cost $12, find the cost of 142 acres.

28. Find the cost of $\frac{3}{4}$ of 28 ounces of butter at 32¢ a pound.

29. At $33\frac{1}{3}$¢ a pair, how many pairs of cuffs can be bought for $8?

30. How much will $9\frac{1}{4}$ yards of lace cost at 36¢ a yard?

31. Find the cost of 186 eggs at 20¢ a dozen.

FACTORS, DIVISORS, AND MULTIPLES

PRIME AND COMPOSITE NUMBERS

LESSON 21

1. What *two* numbers when multiplied together will make 6? 8? 9? 10? 12? 14? 15?

2. What *three* numbers when multiplied together will produce 8? 12? 16? 18? 20? 27? 28? 30?

All numbers that can be formed by multiplying together two or more integral numbers each greater than 1 are called **Composite Numbers.** The numbers that produce composite numbers are called **Factors** (makers). Thus, 3 and 4 are factors of 12, and 3 and 5 are factors of 15.

Numbers that cannot be produced by multiplying together two or more integral numbers, each greater than 1, are called **Prime Numbers.**

3. Name the composite numbers between 1 and 45.

4. Name the prime numbers from 1 to 45.

5. Is 16 a prime or a composite number? Why?

6. What two numbers multiplied together make 12? 21?

7. Are the two factors of 12 prime or composite numbers? Are 3 and 7 (factors of 21) prime numbers? Why? Factors that are prime numbers are called prime factors.

8. What composite number is formed from the two prime factors 2 and 3? 2 and 5? 3 and 5? 2 and 7? 2, 3, and 5? 2, 3, and 7? 2, 5, and 7?

27

Find the composite numbers that equal the following prime factors :

9. $2 \times 3 \times 5 =$	**12.** $3 \times 3 \times 5 =$	**15.** $2 \times 2 \times 3 \times 5 =$
10. $2 \times 2 \times 5 =$	**13.** $3 \times 5 \times 5 =$	**16.** $3 \times 3 \times 3 \times 5 =$
11. $2 \times 2 \times 7 =$	**14.** $2 \times 3 \times 7 =$	**17.** $2 \times 2 \times 3 \times 11 =$

FACTORING

LESSON 22

Factoring is the process of finding the factors, or makers, of a composite number.

Name the *two* prime factors of the following :

1. $4 = 2 ; 2$	**5.** $15 =$	**9.** $21 =$	**13.** $55 =$
2. $9 = 3 ; 3$	**6.** $25 =$	**10.** $26 =$	**14.** $33 =$
3. $10 =$	**7.** $35 =$	**11.** $34 =$	**15.** $77 =$
4. $14 =$	**8.** $22 =$	**12.** $49 =$	**16.** $57 =$

Name the *three* prime factors :

17. $12 = 2 ; 2 ; 3$	**21.** $44 =$	**25.** $50 =$	**29.** $68 =$
18. $20 =$	**22.** $45 =$	**26.** $52 =$	**30.** $78 =$
19. $27 =$	**23.** $63 =$	**27.** $70 =$	**31.** $42 =$
20. $28 =$	**24.** $66 =$	**28.** $75 =$	**32.** $99 =$

The prime factors of any composite number may .be found by dividing the given number by any prime number that will exactly divide it, and the quotient by any prime number that will exactly divide it, and thus continuing to divide the resulting quotient until it becomes a prime number. The several divisors and the last quotient will be the required prime factors.

33. Find the prime factors of 210:

OPERATION I	OPERATION II	OPERATION III
2 | 210	7 | 210	5 | 210
3 | 105	5 | 30	3 | 42
5 | 35	3 | 6	2 | 14
7	2	7

The prime factors of 210, arranged according to their value, are 2, 3, 5, 7.

Find the prime factors of the following:

34. 40, 72, 84, 92, 95, 110, 160, 176, 360, 410, 876.

GREATEST COMMON DIVISOR

LESSON 23

1. Name a number that will exactly divide 10, 21, 25, 28, 32.

2. Name a number that will exactly divide both 9 and 12, 10 and 15, 12 and 16, 24 and 36.

A number that will exactly divide two or more numbers is called a **Common Divisor** of those numbers. Thus, 4 is a common divisor of 28 and 36, since it exactly divides each of them.

3. Name the largest number that will exactly divide 16 and 24, 32 and 40, 36 and 45.

The largest number that will exactly divide two or more numbers is called the **Greatest Common Divisor** of those numbers. Thus, 9 is the greatest common divisor of 18 and 27, since it is the largest number that will exactly divide each of them.

The letters G. C. D. are generally used to denote Greatest Common Divisor.

Name at sight the G. C. D. of :

4. 14, 16	**7.** 32, 44	**10.** 48, 64, 80
5. 27, 30	**8.** 72, 80	**11.** 54, 63, 81
6. 32, 40	**9.** 84, 96	**12.** 60, 72, 96

13. Name all the divisors of 12, 14, 16, 18, 32, 40.

14. Name all the divisors common to 12 and 18, 24 and 36, 60 and 72, 48 and 60, 32 and 40.

LESSON 24

When the numbers are not too large we may easily see, by inspection, the G. C. D. of two or more numbers by first arranging all the divisors of the given numbers in pairs as follows :

$$60 = 2 \times 30, \ 3 \times 20, \ 4 \times 15, \ 5 \times 12, \ 6 \times 10$$
$$72 = 2 \times 36, \ 3 \times 24, \ 4 \times 18, \ 6 \times 12, \ 8 \times 9$$

Arranging in order first the divisors of 60: 2, 3, 4, 5, 6, 10, **12**, 15, 20, 30, and then the divisors of 72: 2, 3, 4, 6, 8, 9, **12**, 18, 24, 36, we readily see that 12 is the G. C. D. of 60 and 72.

The prime factors of 60 are : **2, 2, 3**, 5.
The prime factors of 72 are : **2, 2**, 2, **3**, 3.

It will be seen from the above work that the prime factors common to 60 and 72 are 2 twos and 1 three, the product of which, 12, is the G. C. D.

1. Find the G. C. D. of 48 and 56.

MODEL. $48 = 2 \times 2 \times 2 \times 2 \times 3$
$56 = 2 \times 2 \times 2 \times 7$
$2 \times 2 \times 2 = 8$, G. C. D.

Find the G. C. D. of :

2. 40, 48	**5.** 40, 96	**8.** 45, 75
3. 72, 84	**6.** 56, 60	**9.** 48, 80
4. 64, 72	**7.** 96, 72	**10.** 35, 75

Numbers are *prime to each other* when they have no common divisor, as 7 and 12.

11. Write five pairs of numbers that are prime to each other.

LESSON 25

1																One
$\frac{1}{2}$								$\frac{1}{2}$								Halves
$\frac{1}{4}$				$\frac{1}{4}$				$\frac{1}{4}$				$\frac{1}{4}$				Fourths
$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		Eighths
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	Sixteenths
$\frac{1}{32}$ ... thirty-seconds ...																Thirty-seconds

1. $\frac{1}{2}$ = how many fourths? How many eighths? How many sixteenths? How many thirty-seconds?

2. By what number must you multiply both numerator and denominator of $\frac{1}{2}$ to make it equal $\frac{2}{4}$? $\frac{4}{8}$? $\frac{8}{16}$? $\frac{16}{32}$?

3. Does the diagram show you that $\frac{1}{2} = \frac{2}{4} = \frac{4}{8} = \frac{8}{16} = \frac{16}{32}$?

4. $\frac{3}{8}$ = how many sixteenths? By what number must you multiply both terms of $\frac{3}{8}$ to make it equal $\frac{6}{16}$?

5. $\frac{2}{4}$ = how many sixteenths? What must you do to both numerator and denominator of $\frac{2}{4}$ to make it equal $\frac{8}{16}$?

6. If you multiply both numerator and denominator of $\frac{3}{4}$ by 8, do you change the value of the fraction?

7. Does the diagram show that $\frac{3}{8} = \frac{6}{16}$? $\frac{2}{4} = \frac{8}{16}$? $\frac{3}{4} = \frac{24}{32}$?

8. Does multiplying both numerator and denominator of a fraction by the same number alter the value of the fraction?

9. Change to 8ths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, $1\frac{1}{4}$, $1\frac{3}{4}$, 2, $2\frac{1}{4}$.

10. Change to 16ths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $1\frac{1}{2}$, $1\frac{1}{4}$, $1\frac{3}{4}$, $\frac{5}{8}$, $\frac{6}{8}$.

11. Change to 32ds: $\frac{1}{4}$, $\frac{3}{8}$, $\frac{3}{16}$, $\frac{5}{8}$, $\frac{7}{8}$, $\frac{5}{16}$, $\frac{3}{4}$, $1\frac{1}{4}$.

12. Change to 12ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{6}$, $\frac{5}{6}$, 1.

13. Change to 24ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{3}{8}$, $\frac{7}{12}$.

14. $\frac{1}{3}$ equals how many 6ths? 9ths? 12ths? 15ths?

15. Compare $\frac{3}{4}$ of a foot with $\frac{9}{12}$ of a foot.

16. Compare $\frac{4}{12}$ of a dozen with $\frac{1}{3}$ of a dozen.

LESSON 26

1. By what number must you divide both numerator and denominator of $\frac{8}{16}$ to make it equal $\frac{4}{8}$? $\frac{2}{4}$?

2. By what number must you divide both numerator and denominator of $\frac{12}{16}$ to make it equal $\frac{3}{4}$?

3. Does the diagram on p. 31 show you that $\frac{12}{16} = \frac{6}{8} = \frac{3}{4}$?

4. What must you do to both numerator and denominator of $\frac{24}{32}$ to make it equal $\frac{3}{4}$?

5. If you divide both terms of $\frac{14}{16}$ by 2, what fraction will you get? Have you changed the value of the fraction?

6. Does dividing both numerator and denominator of a fraction by the same number alter the value of the fraction?

7. Change $\frac{6}{8}$ to 4ths; $\frac{8}{12}$ to 6ths; $\frac{8}{12}$ to 4ths; $\frac{8}{16}$ to 4ths; $\frac{9}{12}$ to 4ths; $\frac{12}{16}$ to 8ths; $\frac{10}{12}$ to 6ths; $\frac{12}{32}$ to 16ths.

8. Compare $\frac{8}{12}$ of a day with $\frac{2}{3}$ of a day.

9. What is the G. C. D. of 25 and 40?

10. Divide both numerator and denominator of $\frac{25}{40}$ by their G. C. D. What is your answer?

11. Divide the numerator and denominator of $\frac{36}{42}$ by 6. What fraction do you get for your answer?

12. Is 6 the G. C. D. of 36 and 42? Why?

13. By what number must you divide both terms of $\frac{16}{20}$ to make it equal $\frac{4}{5}$? Are the numerator and denominator of $\frac{16}{20}$ prime to each other? Why?

Are the numerator and denominator of $\frac{4}{5}$ prime to each other? Why? When are numbers prime to each other? (Lesson 24.)

When the numerator and denominator of a fraction are prime to each other, the fraction is said to be in its **lowest terms.**

Change the following fractions to their lowest terms:

14. $\frac{3}{9}, \frac{4}{6}, \frac{8}{12}, \frac{6}{18}, \frac{7}{21}, \frac{14}{21}.$ **15.** $\frac{6}{8}, \frac{9}{12}, \frac{5}{10}, \frac{12}{24}, \frac{10}{20}, \frac{5}{25}.$

LESSON 27

Divide the numerator and denominator of each of the following fractions by their G. C. D.:

1. $\dfrac{25 \div 5 = 5}{35 \div 5 = 7}$ **5.** $\frac{20}{24}$ **9.** $\frac{36}{54}$ **13.** $\frac{45}{60}$

2. $\frac{12}{21}$ **6.** $\frac{22}{24}$ **10.** $\frac{48}{84}$ **14.** $\frac{60}{48}$

3. $\frac{14}{21}$ **7.** $\frac{18}{27}$ **11.** $\frac{40}{60}$ **15.** $\frac{36}{48}$

4. $\frac{18}{21}$ **8.** $\frac{9}{15}$ **12.** $\frac{24}{36}$ **16.** $\frac{33}{44}$

NOTE. — This process is called changing fractions to lowest terms.

17. Write five equivalents for $\frac{1}{2}$.   Thus, $\frac{1}{2} = \frac{2}{4}, \frac{3}{6},$ etc.

18. Write five equivalents for $\frac{1}{3}, \frac{2}{3}, \frac{1}{4}, \frac{2}{5}, \frac{3}{4}.$

19. Change to 4ths : $\frac{6}{8}, \frac{12}{16}, \frac{16}{16}, \frac{5}{20}, \frac{18}{36}, \frac{1}{2}, \frac{15}{60}.$

20. Change to 9ths : $\frac{2}{3}, \frac{8}{18}, 1\frac{2}{9}, \frac{18}{27}, \frac{27}{36}, 2\frac{5}{9}, 3\frac{1}{3}.$

21. Change to 10ths : $\frac{1}{2}, \frac{1}{5}, \frac{4}{5}, \frac{16}{20}, \frac{18}{20}, \frac{38}{40}, 1\frac{3}{10}.$

22. Write all the divisors of 36, 54, 63, 84.

23. Change $\frac{1}{2}$ and $\frac{2}{3}$ to 6ths ; 12ths ; 18ths.

24. Change $\frac{1}{3}$ and $\frac{3}{4}$ to 12ths ; 24ths ; 36ths.

25. Change to 15ths: $1\frac{1}{3}$, $\frac{8}{30}$, $2\frac{1}{3}$, $\frac{5}{6}$, $2\frac{1}{5}$, $2\frac{2}{15}$.

26. Change to lowest terms : $\frac{21}{49}$, $\frac{42}{56}$, $\frac{64}{72}$, $\frac{54}{66}$, $\frac{72}{81}$, $\frac{99}{108}$.

LEAST COMMON MULTIPLE

LESSON 28

When a number can be divided by another without a remainder, it is called a **Multiple** of that number.   Thus, 9 is a multiple of 3.

1. Name the smallest number that is a multiple of 3. Name all the multiples of 3 to 27 ; 4 to 32 ; 5 to 35 ; 6 to 48.

2. Name a multiple of 2 and 3 ; that is, a number that is divisible by 2 and 3.

3. Name a multiple of 3 and 4 ; 5 and 6 ; 6 and 8.

4. Name the least number that can be exactly divided by 4 and 6 ; 3 and 6 ; 6 and 15 ; 3 and 8.

The smallest number that can be divided by two or more numbers without a remainder is called the **Least Common Multiple** (L. C. M.) of those numbers.   Thus, 18 is the least common multiple of 6 and 9, since it is the least number that can be exactly divided by each of them.

Name at sight L. C. M. of :

5. 8 and 12 ; 6 and 9 ; 10 and 15 ; 12 and 16 ; 2, 3, 4, and 6 ; 16 and 24 ; 12 and 15 ; 3, 6, 9, and 12 ; 2, 7, and

14 ; 12, 4, and 18. The L. C. M. of numbers *prime* to each other is simply their product. Thus, the L. C. M. of 3 and 5 is 15 ; of 2, 3, and 7 is 42.

6. Name the L. C. M. of 4 and 5 ; 3 and 8 ; 4 and 5 7 and 8 ; 6 and 11.

7. Name all the prime numbers to 100.

8. What is the G. C. D. of 19 and 38 ? 13 and 26 ?

9. Name the multiples of 8 to 96 ; 9 to 108.

10. Name two equal factors of 9 ; 16 ; 36 ; 49 ; 64 ; 100.

11. Name the L. C. M. of 3, 10, and 12 ; 3, 12, 30, and 5.

LESSON 29

The L. C. M. of two or more numbers must be composed only of the prime factors of each of the numbers.

1. Find the L. C. M. of 6, 9, and 24.

$$\text{MODEL.} \quad 6 = 2 \times 3$$
$$9 = 3 \times 3$$
$$24 = 2 \times 2 \times 2 \times 3$$
$$\text{The L. C. M.} = 2 \times 2 \times 2 \times 3 \times 3 = 72$$

The L. C. M. must contain all the prime factors of 24 ($2 \times 2 \times 2 \times 3$). It must contain the factors of 9 (3×3). We already have one 3 in the factors of 24. Hence we retain one 3 and reject the other. The L. C. M. must also contain the factors of 6 (2×3). As we have these factors already in 24, we reject them also.

The factors and the numbers they represent may be shown as follows:

$$\text{L. C. M., } 72 = \overbrace{2 \times 2 \times \underbrace{2 \times 3}_{6} \underbrace{\times 3}_{9}}^{24}$$

Find the L. C M. of:

2. 24 and 36   **5.** 56 and 70   **8.** 22, 44, and 88

3. 36 and 48   **6.** 42 and 54   **9.** 36, 42, and 54

4. 32 and 48   **7.** 30 and 40   **10.** 54, 72, and 90

Find the G. C. D. of:

11. 30, 34; 36, 40; 24, 36; 48, 80; 40, 65; 144, 168.

Write the prime factors of:

12. 15, 40, 48, 54, 60, 77, 92, 84, 120, 96, 140, 210.

Find the L. C. M. of:

13. 4, 9, and 12; 3, 9, and 7; 6, 12, and 14; 6, 8, and 10; 3, 5, and 7; 2, 9, and 5.

MISCELLANEOUS WORK

LESSON 30·

1. Why are 9 and 17 prime to each other?

2. If $\frac{6}{7}$ of a barrel of oil equals 30 gallons, how many gallons equal $\frac{5}{7}$ of a barrel?

3. Find the cost of $2\frac{1}{2}$ cwt. of sugar at $6 \cancel{c}$ a pound.

4. Change $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$ to 12ths; 24ths.

5. At $12\frac{1}{2} \cancel{c}$ each, how many articles can be bought for \$1?

6. Find the cost of $2\frac{1}{2}$ dozen plates at $5 \cancel{c}$ apiece.

7. What is subtraction? Division? Quotient?

8. What does the denominator of a fraction show?

9. What is a decimal fraction?

10. In .444, the second 4 is what part of the value of the first 4? How many times the value of the third 4?

11. In changing yards to rods, what is your divisor?

12. In changing $\frac{27}{81}$ to 9ths, by what number do you divide both numerator and denominator?

13. When 12ths are changed to 3ds, are the fractional parts larger or smaller?

14. If you divide both terms of $\frac{9}{12}$ by 3, will the value of the fraction be changed?

Multiply:	Divide:	Multiply:
15. 3.6×1.8	**20.** .88 by 8	**25.** $9\frac{3}{10}$ by 8
16. $3.06 \times .7$	**21.** .72 by .3	**26.** 9.3 by .8
17. $51.6 \times .04$	**22.** 10.15 by 5	**27.** $14\frac{7}{10}$ by 6
18. $30.6 \times .12$	**23.** 100.25 by .5	**28.** $42\frac{3}{4}$ by 8
19. 7.001×3.6	**24.** 75.025 by .5	**29.** $3.63 by .3

30. A man has a piece of land 18 rods long and 15 rods wide. How many square yards does it contain? How many rods of fence will be needed to inclose it? How much will the fence cost at 18¢ per foot?

LESSON 31

Write as common fractions, and change to their lowest terms:

1. .25	**3.** .04	**5.** .8	**7.** .55	**9.** .95
2. .35	**4.** .05	**6.** .08	**8.** .75	**10.** .84

Write as decimals:

11. $41\frac{5}{10}$	**13.** $79\frac{25}{100}$	**15.** $49\frac{89}{100}$	**17.** $63\frac{99}{100}$
12. $64\frac{8}{10}$	**14.** $86\frac{4}{5}$	**16.** $36\frac{801}{1000}$	**18.** $79\frac{9}{100}$

19. At $.08 a yard, how many yards of muslin can I buy for $8? $80?

20. If it takes 9.4 yards of cloth to make one suit of clothes, how many suits can be made from 564 yards?

21. If 21 oranges cost $\$\frac{7}{8}$, how many oranges can be bought for $\$1\frac{1}{2}$?

22. Find the L. C. M. of 8, 12, and 16.

23. If 9 bottles of chowchow cost $\$2\frac{1}{4}$, how much will a dozen bottles cost?

24. Change $\frac{2}{5}$ to 15ths; $\frac{4}{7}$ to 28ths; $\frac{5}{8}$ to 24ths.

25. Change to lowest terms: $\frac{7}{14}$, $\frac{12}{18}$, $\frac{15}{20}$, $\frac{16}{20}$, $\frac{24}{36}$.

26. Divide $\frac{4}{9}$ by 4; $\frac{10}{17}$ by 5; $\frac{9}{10}$ by 3; $\frac{12}{13}$ by 4; $\frac{18}{19}$ by 6.

27. If $\frac{4}{8}$ of a ton of straw is worth $\$4$, what part of a ton can you buy for $\$1$?

28. At $\$\frac{3}{5}$ a day, how many dollars will a boy earn in 10 days?

29. How many pieces 4 inches long can be cut from a yard of ribbon? From $1\frac{1}{2}$ yards?

30. A farmer sold $\frac{7}{8}$ of his chickens and had 12 left. How many chickens had he at first?

31. At $\$\frac{1}{4}$ a peck, how many bushels of wheat can you buy for $\$6$?

32. How many bottles holding $\frac{1}{2}$ of a pint each will be required to hold $2\frac{1}{2}$ gallons of ink?

33. What part of $\$1$ is 10 cents? 20 cents? 25 cents? 50 cents? 75 cents? $12\frac{1}{2}$ cents? $33\frac{1}{3}$ cents? $16\frac{2}{3}$ cents? $66\frac{2}{3}$ cents?

LESSON 32

1. How many rods of wire fencing will be required to go round a rectangular field 462 feet long and 330 feet wide? How much will the wire cost at $\$1.60$ per rod?

2. If 1 lb. 7 oz. of butter cost $46\cancel{c}$, how much will 5 lb. 14 oz. cost?

3. Divide 42 mi. 160 rd. 5 yd. by 5.

4. How many years, months (30 da.), and days are there from April 29, 1759, to July 4, 1832?

5. If .25 of a yard of cloth cost $1.60, how much will 78 yards cost?

6. Find the sum of four hundred thirty-three thousand six hundred thirty-four dollars and twenty-nine cents; eighty-nine thousand three hundred dollars and seventy-two cents; forty-six thousand three hundred fifty-two dollars and thirty-six cents; sixty-five thousand seven hundred nine dollars and forty-five cents.

7. From 3 billion 444 million 236 thousand 164 dollars and 93 cents take 2 billion 542 million 370 thousand dollars and 98 cents.

8. How many miles are there in 52,800 feet?

9. How many yards of Brussels carpet $\frac{3}{4}$ yd. wide will cover the floor of a room 36 ft. long and 27 ft. wide?

10. If a boy steps 2 ft. 9 in., how many steps will he take in going from his home to school, a distance of $1\frac{1}{2}$ miles?

11. Divide 853.24 by 102.8; 2088.48 by 15.2.

12. Multiply 845 by .25; by .07; by .006.

13. How many dozen are there in 60 score?

14. Change $12\frac{3}{4}$ gross to dozens.

15. Change $13\frac{5}{8}$ quires to sheets.

16. Find the cost of 9480 ft. of hemlock boards at $18 per M.

CANCELLATION

LESSON 33

Cancellation is an operation to shorten work in division by striking out common factors from both dividend and divisor.

Striking out a factor from any number divides the number by that factor. Thus, to strike out, or to cancel, 7 from 21, is to divide 21 by 7.

Striking out equal factors from both dividend and divisor simply divides both dividend and divisor by those numbers.

1. Divide 210 by 30.

MODEL. $210 \div 30 = 7$ $\dfrac{210}{30} = \dfrac{\overset{1}{2} \times \overset{1}{3} \times \overset{1}{5} \times 7}{\underset{1}{2} \times \underset{1}{3} \times \underset{1}{5}} = \dfrac{7}{1} = 7. \ Ans.$

It will be seen from the preceding operation that equal factors may be rejected from both dividend and divisor without altering the quotient.

2. Divide 150 by 25.

MODEL. $\dfrac{150}{25} = \dfrac{2 \times 3 \times \overset{1}{5} \times \overset{1}{5}}{\underset{1}{5} \times \underset{1}{5}} = \dfrac{6}{1} = 6. \ Ans.$

3. Divide 24 × 28 × 32 by 12 × 14 × 16.

MODEL. $\dfrac{\overset{2}{24} \times \overset{2}{28} \times \overset{2}{32}}{\underset{1}{12} \times \underset{1}{14} \times \underset{1}{16}} = \dfrac{8}{1} = 8. \ Ans.$

4. Divide 48 × 18 × 20 by 12 × 8 × 10.

5. Divide 40 × 64 × 70 by 8 × 10 × 32.

6. $\dfrac{18 \times 36 \times 48}{24 \times 9 \times 12} = ?$ **7.** $\dfrac{24 \times 32 \times 81}{6 \times 8 \times 9} = ?$

8. $\dfrac{3 \times 2 \times 12 \times 8 \times 24}{4 \times 6 \times 36 \times 4} = ?$ **9.** $\dfrac{20 \times 25 \times 15 \times 27}{15 \times 18 \times 10 \times 25} = ?$

10. Find the value of $\frac{3}{5} \times \frac{4}{7} \times \frac{2}{3} \times \frac{5}{18}$ by cancellation.

$$\text{MODEL.} \quad \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{5}}} \times \frac{4}{7} \times \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{9}{\cancel{18}}} = \frac{4}{63} \quad \textit{Ans.}$$

11. Find the value of $\frac{3}{5} \times \frac{8}{9} \times \frac{5}{7} \times \frac{7}{15}$ by cancellation.

12. Find the value of $\frac{2}{7} \times \frac{5}{12} \times \frac{24}{25} \times \frac{7}{8}$ by cancellation.

13. $\frac{7}{10} \times \frac{3}{5} \times \frac{5}{9} \times \frac{25}{27} = ?$ **14.** $\frac{3}{8} \times \frac{9}{15} \times \frac{10}{18} \times \frac{16}{27} = ?$

15. Divide $99 \times 66 \times 21 \times 6$ by $33 \times 22 \times 7$.

16. Divide $36 \times 72 \times 96 \times 144$ by $24 \times 36 \times 48 \times 72$.

17. Divide $48 \times 27 \times 13 \times 9$ by $18 \times 16 \times 3 \times 26$.

18. Divide $125 \times 96 \times 57 \times 15$ by $16 \times 19 \times 25$.

19. If 28 tons of coal cost $84, how much will 35 tons cost?

If 28 tons cost $ 84, *one* ton will cost $\frac{1}{28}$ of $ 84, or $ $\frac{84}{28}$, and 35 tons will cost 35 times $ $\frac{84}{28}$, or $\dfrac{35 \times \$\overset{3}{\cancel{84}}}{\underset{1}{\cancel{28}}}$, or $ 105.

OPERATION

$$\dfrac{35 \times \$\overset{3}{\cancel{84}}}{\underset{}{\cancel{28}}} = \$105 \ \textit{Ans.}$$

20. At $ 3 a day, how many weeks must a stone mason work to pay for 21 tons of coal at $ 4 a ton?

21. How much must be paid for 42 gallons of molasses when $ 18 are paid for 36 gallons?

22. A farmer sold a barrel of cider, containing 31 gallons, for 14 cents a gallon. How many pounds of sugar, at 7 cents a pound, can he buy for what he receives for the cider?

PERCENTAGE

Instead of saying $\frac{2}{100}$, $\frac{5}{100}$, $\frac{9}{100}$, etc., we may use the term *per cent* for the denominator, hundredths; thus, 2 *per cent*, 5 *per cent*, 9 *per cent;* etc.

The sign $\%$ is generally used for the term *per cent;* thus, 2%, 5%, 9%, etc. Therefore 1% means $\frac{1}{100}$; 2%, $\frac{2}{100}$; 3%, $\frac{3}{100}$; 4%, $\frac{4}{100}$; etc.

The *per cent* may be expressed in the form of a common fraction, or of a decimal. Thus, $5\% = \frac{5}{100} = .05$.

The process of computing by hundredths is called **Percentage.**

1. What per cent of a number is $\frac{1}{100}$ of it? $\frac{2}{100}$? $\frac{3}{100}$? $\frac{4}{100}$? $\frac{5}{100}$? $\frac{10}{100}$? $\frac{25}{100}$? $\frac{50}{100}$? $\frac{75}{100}$? $\frac{80}{100}$? $\frac{90}{100}$? $\frac{100}{100}$?

2. What part of a number is 1% of it? 2%? 3%? 5%? 10%? 20%? 30%? 40%? 50%? 75%? 80%? 90%? 100%?

3. What per cent of a number is $\frac{1}{2}$ of it?

MODEL. The number equals 100%. $\frac{1}{2}$ of the number equals $\frac{1}{2}$ of 100%, or 50%.

4. What per cent of a number is $\frac{1}{4}$ of it? $\frac{3}{4}$? $\frac{1}{3}$? $\frac{2}{3}$? $\frac{1}{5}$? $\frac{2}{5}$? $\frac{4}{5}$? $\frac{1}{6}$? $\frac{5}{6}$? $\frac{1}{7}$? $\frac{1}{8}$? $\frac{5}{8}$? $\frac{7}{8}$? $\frac{1}{10}$? $\frac{3}{10}$? $\frac{7}{10}$? $\frac{9}{10}$? $\frac{1}{12}$? $\frac{7}{12}$? $\frac{1}{20}$? $\frac{7}{20}$? $\frac{1}{50}$?

5. What common fraction equals 25%?

MODEL. 25% equals $\frac{25}{100}$, or $\frac{1}{4}$.

6. What common fraction equals 5%? 4%? 10%? 20%? 30%? 35%? 50%? 75%? 80%? 90%?

Memorize thoroughly:

7. $6\frac{1}{4}\% = \frac{1}{16}$ **10.** $8\frac{1}{3}\% = \frac{1}{12}$ **13.** $37\frac{1}{2}\% = \frac{3}{8}$

8. $12\frac{1}{2}\% = \frac{1}{8}$ **11.** $33\frac{1}{3}\% = \frac{1}{3}$ **14.** $62\frac{1}{2}\% = \frac{5}{8}$

9. $16\frac{2}{3}\% = \frac{1}{6}$ **12.** $66\frac{2}{3}\% = \frac{2}{3}$ **15.** $87\frac{1}{2}\% = \frac{7}{8}$

LESSON 35

Express as a decimal, and as a common fraction in lowest terms:

1. $25\% = .25 = \frac{1}{4}$ **7.** 40% **13.** 32% **19.** 62%

2. 15% **8.** 4% **14.** 26% **20.** 65%

3. 12% **9.** 45% **15.** 55% **21.** 76%

4. 8% **10.** 50% **16.** 42% **22.** 90%

5. 30% **11.** 10% **17.** 85% **23.** 36%

6. 35% **12.** 28% **18.** 88% **24.** 5%

Find :

25. $\frac{6}{100}$ of 400.

MODEL. $\frac{1}{100}$ of 400 is 4, and $\frac{6}{100}$ of 400 are 6 times 4, or 24 *Ans.*

26. $.06$ of 300 **30.** 6% of 200 **34.** 5% of 100

27. $.06$ of 400 **31.** 6% of 600 **35.** 5% of 200

28. 6% of 400 **32.** 6% of 300 **36.** 5% of 300

29. 6% of 500 **33.** 6% of 50 **37.** 5% of 500

38. Find 4% of 100, 200, 125, 175, 150, 225, 300, 275.

39. Find $12\frac{1}{2}\%$ of 16, 24, 168, 48, 72, 88, 96, 248.

40. Find 50% of 8, 10, 14, 28, 80, 85, 125, 350.

41. Find 25% of 12, 20, 32, 44, 52, 80, 36, 88.

42. Find 33⅓% of $18, 21 in., 66 rd., 72 da., 100 yd., 96 bu.

43. Find ½% of 400.

MODEL. 1% of 400 = $\frac{1}{100}$ of 400, or 4, and ½% = ½ of 4, or 2 *Ans.*

44. Find ½% of 500, 600, 800, 900, $1200, $13,200, $1000.

45. Find ¼% of 800, 1200 rd., 1600 T., 2400 A., 3200 mi.

46. Find 75% of $160, $400.40, 144 calves, 4.68 yd., $.72.

47. Find 66⅔% of $180, 360 gal., 240 cows, $438.96, 930 oz.

48. Find 8⅓% of $.96, $2.16, 1440 in., .048 ft., 60.96 da.

49. Find 87½% of 320 yd., $16.80, 48.8 qt., 600 yd.

50. Find 62½% of $640, $12.80, 24.8 pk., .8 A., .248 pt.

LESSON 36

1. What is 21% of $186?

MODEL. 21% of $186 = $186 × .21 = $39.06 *Ans.*

What is:

2. 24% of 760 yd.?

3. 35% of 630 hr.?

4. 46% of 860 gal.?

5. 72% of $560?

6. 22% of 760 bu.?

7. 19% of $860?

8. 77% of 320 A.?

9. 16% of 650 sheep?

10. 12½% of 720 mi.?

11. 83⅓% of 168 in.?

12. 56¼% of $144?

13. 65% of $200?

14. A man had 2560 bushels of potatoes, and sold 25% of them. How many bushels did he sell?

15. A man invested $2000 in business, and lost 40% of it. How many dollars had he left?

16. A carpenter worked 30% of 360 days in 1899. How many days did he work?

17. A farmer raised 1680 bushels of wheat, and sold $33\frac{1}{3}$ of it at 80¢ a bushel. How much did he receive for what he sold?

18. What is $6\frac{2}{3}$% of $840? Of 660 rd.? Of 126 gal.? Of 369 cents?

19. A man sold 32% of 840 acres of land at $60 an acre. How much did he receive for what he sold?

20. A man raised 560 chickens. He sold 40% of them at $3 a dozen. How much did he receive?

21. If I buy a horse for $180 and sell him for $12\frac{1}{2}$% more than I paid for him, how much do I receive?

22. A man bought 16,000 acres of woodland and sold 25% of it at one time, and $33\frac{1}{3}$% of the remainder at another time. How many acres had he left?

LESSON 37

1. 10% of a class of 40 pupils were absent one day. How many pupils were present?

2. 25% of 2 gallons equals how many quarts?

3. What part of a quantity is $33\frac{1}{3}$% of it?

4. How much of a quantity is 100% of it? 125%? $133\frac{1}{3}$%? 150%? 200%? $166\frac{2}{3}$? $137\frac{1}{2}$%? 225%? 175%? $187\frac{1}{2}$%? 325%?

5. How much is 125% of $8 ? $24 ? **16** gallons?

6. What is 1% of $100 ? $\frac{1}{2}$% ? $\frac{1}{4}$% ? $\frac{3}{4}$% ? $\frac{2}{5}$% ?

7. What per cent of a yard is $\frac{3}{4}$ of it ?

8. 75% of a yard is how many inches ?

9. How much is 200% of $100 ? $125 ? $3.50 ? 600 bu. ?

10. A boy earned 40¢ and spent 12$\frac{1}{2}$% of it. How much was left ? What % was left ?

11. How many pounds are there in 75% of a ton ? In 75% of .5 of a ton ? In 33$\frac{1}{3}$% of .75 of a ton ?

12. Robert has 80¢. Elizabeth's money is 175% of Robert's. How much money has Elizabeth ?

13. Fifteen out of every hundred is what per cent ?

14. If a man had 300 dozen eggs and sold 15% of them, how many dozen did he sell ?

15. What per cent is $\frac{1}{2}$ of 50%? 50% of 50%? $\frac{1}{3}$ of 75%? 33$\frac{1}{3}$% of 75%? $\frac{1}{4}$ of 60%? 25% of 60%?

16. If I buy a knife for 75¢ and sell it at a gain of 100%, how much do I get for it ?

17. How many quarts are there in 12$\frac{1}{2}$% of $\frac{1}{2}$ bu. of beans ?

18. What % of a quantity is $\frac{2}{3}$ of it ? $\frac{3}{4}$? $\frac{3}{8}$? $\frac{7}{8}$?

19. A man bought a wheelbarrow for $3.60 and sold it at a gain of 33$\frac{1}{3}$%. How much did he receive for it ?

20. What is 66$\frac{2}{3}$% of a day ? Of a minute ? Of a yard ?

21. Martin Kaiser sold 20 out of every hundred of his turkeys. If he had 250 at first, how many did he sell?

22. What is 37$\frac{1}{2}$% of .64 ? Of $\frac{8}{9}$? Of $\frac{16}{21}$?

23. A druggist bought quinine at 32¢ an ounce and sold it at a gain of 500%. How much did he receive for one ounce ?

FRACTIONS

LESSON 38

Change.

1. 14 to 20ths.

MODEL. $1 = \frac{20}{20}$; $14 = 14 \times \frac{20}{20} = \frac{280}{20}$ *Ans.*

2. 18 to 16ths ;   32 to 12ths ;   35 to 40ths ;   45 to 9ths.

3. $164\frac{2}{3}$ to 3ds.

MODEL. $1 = \frac{3}{3}$; $164 = 164 \times \frac{3}{3} = \frac{492}{3}$; $\frac{492}{3} + \frac{2}{3} = \frac{494}{3}$ *Ans.*

4. $22\frac{3}{4}$ to 4ths ; $16\frac{3}{8}$ to 8ths ; $25\frac{2}{7}$ to 7ths ; $48\frac{5}{18}$ to 18ths.

In practice we multiply the whole number by the denominator of the fraction, and add to the product the numerator of the fraction, and write the denominator of the fraction under the sum.

OPERATION

5. Change $21\frac{4}{5}$ to an improper fraction.

$$21\frac{4}{5}$$
$$5$$
$$\overline{\frac{109}{5}}\ Ans.$$

6. Change $26\frac{5}{9}$ to an improper fraction.

7. Change $\frac{235}{11}$ to a mixed number.

OPERATION

$\frac{11}{11} = 1$, hence $\frac{235}{11} =$ as many 1's as 11 is contained times in 235, which is $21\frac{4}{11}$.

$$11)235(21\frac{4}{11}\ Ans.$$
$$22$$
$$\overline{15}$$
$$11$$
$$\overline{4}$$

Change to whole or mixed numbers :

8. $\frac{263}{9}$, $\frac{564}{4}$, $\$\frac{105}{5}$, $\frac{279}{9}$ rd., $\frac{873}{36}$ ft.

9. Change $\frac{5}{12}$ and $\frac{7}{9}$ to 36ths.

OPERATION

Both terms of each fraction are multiplied by that number which will raise the denominators of the given fractions to the required denominator. (Lesson 25, 8th.)

$$\frac{5}{12} = \frac{5 \times 3}{12 \times 3} = \frac{15}{36}$$

$$\frac{7}{9} = \frac{7 \times 4}{9 \times 4} = \frac{28}{36}$$

Change :

10. $\frac{9}{10}$ and $\frac{3}{20}$ to 60ths.   **13.** $\frac{9}{13}$ to 39ths.

11. $\frac{8}{9}$ and $\frac{11}{24}$ to 72ds.   **14.** $\frac{13}{21}$ to 84ths.

12. $\frac{7}{8}$ and $\frac{4}{5}$ to 40ths.   **15.** $\frac{34}{41}$ to 205ths.

LESSON 39

1. Change $\frac{16}{20}$ to 5ths.

$\frac{1}{5} = \frac{4}{20}$, hence $\frac{16}{20} =$ as many $\frac{1}{5}$'s as 4 is contained times in 16, which is 4, therefore $\frac{16}{20} = \frac{4}{5}$.

Both terms of the fraction are divided by that number which will reduce the denominator of the given fraction to the required denominator.

OPERATION

$$\frac{16}{20} = \frac{16 \div 4}{20 \div 4} = \frac{4}{5} \; Ans.$$

The value of a fraction is not changed if both numerator and denominator are divided by the same number. (Lesson 26, 6th.)

2. Change $\frac{12}{15}$ to 5ths.   **4.** Change $\frac{36}{48}$ to 4ths.

3. Change $\frac{18}{20}$ to 10ths.   **5.** Change $\frac{21}{49}$ to 7ths.

A fraction is in its lowest terms when the numerator and denominator are prime to each other.

6. Reduce $\frac{120}{168}$ to its lowest terms.

We may reduce any fraction to its lowest terms, either by dividing both numerator and denominator successively by common factors, as in operations I and II, or by dividing both terms by their G. C. D. as in operation III.

OPERATION I

$$3\left|\frac{120}{168}\right. = \frac{40}{56}; \quad 8\left|\frac{40}{56}\right. = \frac{5}{7} \; Ans.$$

OPERATION II

$$4\left|\frac{120}{168}\right. = \frac{30}{42}; \quad 6\left|\frac{30}{42}\right. = \frac{5}{7} \; Ans.$$

OPERATION III

$$24\left|\frac{120}{168}\right. = \frac{5}{7} \; Ans.$$

7. Change to lowest terms : $\frac{24}{36}$, $\frac{32}{48}$, $\frac{48}{60}$, $\frac{80}{120}$, $\frac{100}{150}$, $\frac{25}{120}$, $\frac{40}{160}$, $\frac{75}{400}$, $\frac{48}{64}$, $\frac{105}{135}$, $\frac{75}{120}$.

LESSON 40

When the denominators of several fractions are similar, they are said to have a **Common Denominator**. Thus, $\frac{5}{9}$ and $\frac{7}{9}$ have a common denominator.

The smallest common denominator which several fractions may have is called their **Least Common Denominator**. The least common denominator which $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$ may have is 12.

Thus, $\frac{2}{3} = \frac{8}{12}$, $\frac{3}{4} = \frac{9}{12}$, $\frac{5}{6} = \frac{10}{12}$.

Change to equivalent fractions having L. C. D.:

1. $\frac{2}{3}$, $\frac{1}{2}$, $\frac{5}{6}$ 4. $\frac{2}{3}$, $\frac{5}{12}$, $\frac{1}{6}$ 7. $\frac{3}{8}$, $\frac{5}{6}$, $\frac{2}{3}$

2. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$ 5. $\frac{3}{4}$, $\frac{5}{6}$, $\frac{1}{9}$ 8. $\frac{3}{4}$, $\frac{3}{16}$, $\frac{5}{8}$

3. $\frac{4}{5}$, $\frac{1}{10}$, $\frac{1}{2}$ 6. $\frac{1}{2}$, $\frac{2}{7}$, $\frac{1}{14}$ 9. $\frac{1}{3}$, $\frac{5}{9}$, $\frac{2}{27}$

10. Change $\frac{5}{6}$, $\frac{7}{12}$, $\frac{13}{18}$ to their least common denominator.

Least common denominator is 36. Both terms of each fraction are multiplied by that number which will raise the denominators of the given fractions to the required denominator.

To find the number by which we multiply, we divide the required denominator by the denominators of the several fractions.

OPERATION

$$\frac{5}{6} = \frac{5 \times 6}{6 \times 6} = \frac{30}{36}$$

$$\frac{7}{12} = \frac{7 \times 3}{12 \times 3} = \frac{21}{36}$$

$$\frac{13}{18} = \frac{13 \times 2}{18 \times 2} = \frac{26}{36}$$

Change to their L. C. D.:

11. $\frac{4}{5}$, $\frac{2}{3}$, $\frac{7}{15}$ 14. $\frac{7}{12}$, $\frac{3}{8}$, $\frac{3}{4}$ 17. $\frac{5}{9}$, $\frac{7}{18}$, $\frac{11}{36}$

12. $\frac{6}{7}$, $\frac{4}{21}$, $\frac{11}{42}$ 15. $\frac{3}{6}$, $\frac{7}{10}$, $\frac{4}{5}$ 18. $\frac{8}{9}$, $\frac{5}{8}$, $\frac{13}{72}$

13. $\frac{3}{4}$, $\frac{7}{10}$, $\frac{3}{6}$ 16. $\frac{3}{2}$, $\frac{7}{11}$, $\frac{5}{22}$ 19. $\frac{5}{7}$, $\frac{21}{77}$, $\frac{7}{11}$

LESSON 41

The least common denominator of several fractions is their **Least Common Multiple**.

Therefore when the L. C. D. of several fractions cannot be easily found by inspection it may be found as follows:

1. Change $\frac{4}{9}$, $\frac{7}{36}$, $\frac{4}{5}$ to their L. C. D.

MODEL. $9 = 3 \times 3$
$36 = 2 \times 2 \times 3 \times 3$
$5 = 1 \times 5$

$2 \times 2 \times 3 \times 3 \times 5 = 180 = $ L. C. M. of the denominators, which is the L. C. D. to which the fractions may be reduced.

$180 \div 9 = 20$; $\dfrac{4 \times 20}{9 \times 20} = \dfrac{80}{180}$ $180 \div 36 = 5$; $\dfrac{7 \times 5}{36 \times 5} = \dfrac{35}{180}$

$180 \div 5 = 36$; $\dfrac{4 \times 36}{5 \times 36} = \dfrac{144}{180}$

Change to their L. C. D.:

2. $\frac{1}{6}$, $\frac{5}{9}$, $\frac{7}{15}$ **5.** $\frac{7}{8}$, $\frac{11}{12}$, $\frac{25}{32}$ **8.** $\frac{4}{5}$, $\frac{7}{10}$, $\frac{11}{12}$

3. $\frac{5}{8}$, $\frac{3}{32}$, $\frac{1}{96}$ **6.** $\frac{5}{9}$, $\frac{8}{15}$, $\frac{31}{45}$ **9.** $\frac{17}{20}$, $\frac{4}{15}$, $\frac{7}{12}$

4. $\frac{3}{5}$, $\frac{7}{8}$, $\frac{9}{10}$ **7.** $\frac{47}{14}$, $\frac{5}{7}$, $\frac{23}{21}$ **10.** $\frac{17}{24}$, $\frac{7}{12}$, $\frac{8}{16}$

11. When is a fraction said to be in its lowest terms?

12. How do you reduce a fraction to its lowest terms?

13. Change $5\frac{3}{4}$ to an improper fraction.   Give analysis.

14. In practice, how do we change a mixed number to an improper fraction?

15. How many 4ths of a yard in $9\frac{3}{4}$ yards?

16. Change $\frac{3}{4}$ to 5 equivalent fractions.

17. Name several denominators to which 6ths and 8ths may be reduced.

ADDITION

LESSON 42

Add:

1. $\frac{3}{4}$ and $\frac{7}{12}$ **3.** $\frac{4}{5}$ and $\frac{2}{3}$ **5.** $\frac{1}{8}$ and $\frac{3}{5}$

2. $\frac{1}{3}$ and $\frac{1}{7}$ **4.** $\frac{1}{6}$ and $\frac{1}{4}$ **6.** $\frac{1}{4}$ and $\frac{1}{7}$

7. $\frac{2}{3}$ and $\frac{1}{15}$ **10.** $\frac{8}{9}$ and $\frac{1}{3}$ **13.** $\frac{7}{8}$ and $\frac{1}{8}$

8. $\frac{1}{4}$ and $\frac{1}{8}$ **11.** $\frac{3}{4}$ and $\frac{5}{6}$ **14.** $\frac{5}{6}$ and $\frac{1}{4}$

9. $\frac{2}{7}$ and $\frac{3}{14}$ **12.** $\frac{1}{2}$ and $\frac{3}{8}$ **15.** $\frac{1}{6}$ and $\frac{1}{11}$

16. John spent $\frac{4}{5}$ of a dollar for a pair of gloves and $\frac{1}{10}$ of a dollar for a collar. What part of a dollar did both cost him?

17. A boy rode $\frac{3}{6}$ of a mile and walked $\frac{3}{4}$ of a mile. How far did he go? •

18. How much silk are $3\frac{1}{2}$ yards and $4\frac{2}{3}$ yards?

MODEL. 3 yards + 4 yards = 7 yards. $\frac{1}{2}$ yard + $\frac{2}{3}$ yard = $\frac{7}{6}$ yards, or $1\frac{1}{6}$ yards. 7 yards + $1\frac{1}{6}$ yards = $8\frac{1}{6}$ yards.

19. How many gallons are $3\frac{1}{8}$ gallons and $\frac{4}{5}$ gallon?

20. How many inches are $3\frac{1}{4}$ in. and $2\frac{1}{8}$ in.?

21. Add by $1\frac{1}{2}$ from $\frac{1}{2}$ to $15\frac{1}{2}$.

22. A farmer sold $\frac{3}{4}$ dozen eggs to one man, $\frac{2}{3}$ dozen to another, and $\frac{5}{6}$ dozen to another. How many dozen did he sell?

23. How many pounds are $5\frac{2}{3}$ lb. and $4\frac{5}{6}$ lb.? •

24. What is the sum of $\$\frac{2}{3}$, $\$\frac{3}{4}$, and $\$\frac{7}{12}$?

25. Add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$; $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{6}$; $\frac{1}{2}$, $\frac{1}{5}$, $\frac{1}{8}$; $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{4}$.

LESSON 43

1. Find the sum of $\frac{4}{5}$, $\frac{9}{10}$, and $\frac{7}{12}$

L. C. D. = 60

MODEL. $\quad \dfrac{4}{5} = \dfrac{4 \times 12}{5 \times 12} = \dfrac{48}{60}$

$\dfrac{9}{10} = \dfrac{9 \times 6}{10 \times 6} = \dfrac{54}{60}$

$\dfrac{7}{12} = \dfrac{7 \times 5}{12 \times 5} = \dfrac{35}{60}$

$\dfrac{48}{60} + \dfrac{54}{60} + \dfrac{35}{60} = \dfrac{137}{60} = 2\frac{17}{60}$ *Ans.*

2. Add $\frac{2}{5}$, $\frac{7}{8}$, and $\frac{9}{10}$.

3. Add $\frac{5}{6}$, $\frac{7}{13}$, and $\frac{3}{8}$.

4. Add $\frac{5}{12}$, $\frac{4}{6}$, and $\frac{5}{18}$.

5. Add $\frac{4}{5}$, $\frac{13}{20}$, and $\frac{19}{48}$.

6. Add $\frac{5}{7}$, $\frac{15}{28}$, and $\frac{3}{42}$.

7. Add $\frac{7}{8}$, $\frac{11}{12}$, and $\frac{25}{32}$.

8. Add $\frac{5}{13}$, $\frac{5}{6}$, and $\frac{17}{91}$.

9. Add $\frac{5}{8}$, $\frac{11}{16}$, and $\frac{29}{48}$.

10. Add $\frac{15}{16}$, $\frac{5}{6}$, and $\frac{27}{56}$.

11. Add $\frac{2}{11}$, $\frac{8}{33}$, and $\frac{20}{44}$.

12. Find the sum of $7\frac{3}{4}$, $8\frac{3}{16}$, and $18\frac{7}{12}$.

MODEL. $7 + 8 + 18 = 33$, sum of integers.

$\frac{3}{4} + \frac{3}{16} + \frac{7}{12} = \frac{71}{48} = \underline{1\frac{23}{48}}$, sum of fractions.

Entire sum $= \overline{34\frac{23}{48}}$.

Find the sum of :

13. $4\frac{5}{8}$, $9\frac{5}{12}$, and $18\frac{7}{24}$

14. $25\frac{5}{9}$, $3\frac{5}{18}$, and $22\frac{2}{3}$

15. $18\frac{3}{4}$, $9\frac{3}{8}$, and $21\frac{5}{48}$

16. $14\frac{5}{7}$, $21\frac{9}{14}$, and $15\frac{9}{28}$

17. $51\frac{3}{5}$, $6\frac{7}{15}$, and $9\frac{5}{6}$

18. $29\frac{5}{9}$, $46\frac{2}{3}$, and $21\frac{4}{15}$

19. $14\frac{4}{11}$, $26\frac{9}{22}$, and $43\frac{17}{33}$

20. $47\frac{2}{3}$, $43\frac{5}{7}$, and $19\frac{11}{42}$

21. A man bought 3 loads of coal. The first load weighed $1\frac{1}{3}$ tons, the second $1\frac{1}{6}$ tons, and the third $1\frac{1}{4}$ tons. How many tons did he buy ?

22. I bought a coat for \$35$\frac{4}{5}$, a vest for \$9$\frac{3}{8}$, shoes for \$8, and a hat for \$4$\frac{3}{4}$. How much did I pay for all ?

SUBTRACTION

LESSON 44

What is the value of :

1. $\frac{1}{2} - \frac{1}{3}$?

2. $\frac{2}{3} - \frac{1}{2}$?

3. $\frac{1}{4} - \frac{1}{5}$?

4. $\frac{1}{3} - \frac{1}{4}$?

5. $\frac{1}{5} - \frac{1}{6}$?

6. $\frac{3}{4} - \frac{2}{3}$?

7. $\frac{1}{5} - \frac{1}{6}$?

8. $\frac{4}{5} - \frac{2}{3}$?

9. $\frac{1}{9} - \frac{1}{10}$?

10. $\frac{4}{5} - \frac{2}{3}$?

11. $\frac{5}{6} - \frac{3}{4}$?

12. $\frac{5}{6} - \frac{3}{8}$?

13. $\frac{5}{9} - \frac{5}{12}$?

14. $\frac{3}{8} - \frac{1}{4}$?

15. $\frac{5}{9} - \frac{2}{5}$?

16. If I spend $\frac{1}{3}$ and $\frac{1}{6}$ of my money, what part of my money remains?

17. $\frac{3}{8}$ inch and how many 8th-inches make $\frac{21}{24}$ inch?

18. $7\frac{1}{3}$ inches and how many inches make 12 inches?

19. From $\frac{8}{9}$ take $\frac{7}{10}$.

MODEL. L. C. D. = 90

$$\frac{8}{9} = \frac{8 \times 10}{9 \times 10} = \frac{80}{90}$$

$$\frac{7}{10} = \frac{7 \times 9}{10 \times 9} = \frac{63}{90}$$

$$\frac{80}{90} - \frac{63}{90} = \frac{17}{90} \quad Ans.$$

20. $\frac{7}{12} - \frac{2}{9} = ?$ **24.** $\frac{11}{12} - \frac{2}{3} = ?$ **28.** $\frac{18}{40} - \frac{1}{10} = ?$

21. $\frac{7}{9} - \frac{3}{7} = ?$ **25.** $\frac{17}{18} - \frac{5}{6} = ?$ **29.** $\frac{25}{63} - \frac{3}{14} = ?$

22. $\frac{17}{21} - \frac{5}{7} = ?$ **26.** $\frac{18}{25} - \frac{7}{10} = ?$ **30.** $\frac{57}{90} - \frac{6}{14} = ?$

23. $\frac{10}{11} - \frac{7}{8} = ?$ **27.** $\frac{28}{35} - \frac{3}{10} = ?$ **31.** $\frac{13}{15} - \frac{5}{7} = ?$

32. From 12 take $\frac{5}{9}$.

MODEL. $12 = 11\frac{9}{9}$; $11\frac{9}{9} - \frac{5}{9} = 11\frac{4}{9}$ $Ans.$

33. $13 - \frac{5}{6} = ?$ **35.** $22 - \frac{8}{13} = ?$ **37.** $39 - \frac{19}{21} = ?$

34. $18 - \frac{7}{12} = ?$ **36.** $28 - \frac{12}{13} = ?$ **38.** $46 - \frac{21}{28} = ?$

LESSON 45

1. From 29 take $16\frac{7}{8}$.

MODEL. $29 = 28\frac{8}{8}$;
$28\frac{8}{8} - 16\frac{7}{8} = 12\frac{1}{8}$ $Ans.$

5. From $17\frac{3}{5}$ take $\frac{7}{9}$.

MODEL. $17\frac{3}{5} = 16\frac{72}{45}$; $\frac{7}{9} = \frac{35}{45}$.
$16\frac{72}{45} - \frac{35}{45} = 16\frac{37}{45}$ $Ans.$

2. From 49 take $18\frac{9}{11}$.

6. From $29\frac{5}{12}$ take $\frac{7}{8}$.

3. From 51 take $49\frac{7}{13}$.

7. From $46\frac{3}{13}$ take $\frac{8}{26}$.

4. From 56 take $54\frac{8}{15}$.

8. From $59\frac{7}{18}$ take $\frac{8}{9}$.

9. From $8\frac{4}{11}$ take $3\frac{5}{6}$.

MODEL. $8\frac{4}{11} = 7\frac{90}{66}$; $3\frac{5}{6} = 3\frac{55}{66}$.
$7\frac{90}{66} - 3\frac{55}{66} = 4\frac{35}{66}$ $Ans.$

10. $16\frac{4}{7} - 8\frac{7}{35} = ?$

11. $24\frac{9}{16} - 7\frac{5}{8} = ?$

12. $9\frac{5}{11} - 3\frac{5}{6} = ?$

13. $12\frac{3}{8} - 7\frac{11}{12} = ?$

14. $29\frac{3}{4} - 6\frac{4}{5} = ?$

15. $49\frac{3}{8} - 21\frac{3}{5} = ?$

16. $17\frac{3}{4} - 9\frac{5}{7} = ?$

17. $28\frac{1}{16} - 19\frac{5}{24} = ?$

18. $72\frac{2}{15} - 65\frac{7}{20} = ?$

19. $16\frac{13}{42} - 9\frac{5}{7} = ?$

20. $43\frac{9}{11} - 15\frac{4}{7} = ?$

21. $91\frac{3}{9} - 27\frac{5}{6} = ?$

22. $95\frac{5}{6} - 45\frac{2}{7} = ?$

23. $58\frac{3}{4} - 43\frac{3}{7} = ?$

24. $42\frac{5}{7} - 28\frac{5}{9} = ?$

25. $98\frac{5}{9} - 37\frac{7}{8} = ?$

26. From a bin containing $96\frac{3}{4}$ bushels of wheat $49\frac{5}{6}$ bushels were sold. How many bushels remained in the bin?

27. From a piece of cambric containing $65\frac{3}{8}$ yards there were sold at one time $16\frac{3}{4}$ yards, and at another time $17\frac{5}{9}$ yards. How many yards remained?

28. Charles can build a certain fence in $12\frac{2}{3}$ days; William can build it in $1\frac{3}{5}$ days less. In what time can William build it?

29. Four loads of coal weighed, respectively, $1\frac{2}{3}$ tons, $1\frac{1}{4}$ tons, $1\frac{3}{10}$ tons, and $1\frac{7}{25}$ tons. What was the entire weight?

LESSON 46

1. $28 - 7\frac{4}{7} + 2\frac{1}{2} = ?$

2. $13\frac{5}{9} - \frac{3}{5} + 3\frac{1}{3} = ?$

3. $7\frac{7}{9} - 6\frac{1}{3} + \frac{4}{27} = ?$

4. $\frac{11}{12} - \frac{2}{3} + 16\frac{4}{5} = ?$

5. $13\frac{5}{8} - 4\frac{7}{8} + \frac{5}{6} = ?$

6. $7\frac{5}{7} + 8\frac{3}{4} - 4\frac{3}{4} = ?$

7. $17\frac{4}{5} + 8\frac{1}{2} - 12\frac{9}{10} = ?$

8. $9\frac{3}{8} - 3\frac{5}{6} - 2\frac{3}{8} = ?$

9. $120 - 95\frac{5}{6} + \frac{3}{5} = ?$

10. $19\frac{4}{15} - 7\frac{11}{30} - 5 = ?$

11. $18\frac{4}{5} + 9\frac{1}{2} - 8\frac{9}{10} = ?$

12. $8\frac{5}{9} + 7\frac{11}{18} - 9\frac{5}{6} = ?$

13. $\frac{19}{21} - \frac{9}{42} + 3\frac{5}{7} = ?$

14. $\frac{3}{4} + 9\frac{1}{5} - 2\frac{1}{3} = ?$

15. $\frac{14}{15} + 8\frac{3}{5} - \frac{31}{45} = ?$

16. $8\frac{1}{8} - \frac{3}{5} + 16\frac{1}{2} = ?$

17. $16\frac{4}{7} + 7\frac{9}{11} - \frac{5}{7} = ?$

18. $9\frac{1}{8} + \frac{17}{32} - 6\frac{9}{16} = ?$

19. $17\frac{5}{8} - 8\frac{11}{24} + 21 = ?$ **22.** $7\frac{5}{6} + 18\frac{13}{16} - 9\frac{4}{5} = ?$

20. $29\frac{3}{4} - 7\frac{1}{5} - 16\frac{3}{10} = ?$ **23.** $48\frac{1}{16} - 12\frac{5}{8} + 16\frac{7}{48} = ?$

21. $20 - 8\frac{7}{40} + 12\frac{5}{8} = ?$ **24.** $6\frac{3}{8} + 9\frac{1}{7} - 1\frac{4}{70} = ?$

25. A man raised $72\frac{5}{8}$ bu. of corn in one field, $65\frac{3}{4}$ bu. in another, and $149\frac{11}{12}$ bu. in another. How many did he raise in the three fields together?

26. A miller bought $78\frac{29}{60}$ bu. of wheat from A, and $86\frac{5}{12}$ bu. from B. How many bushels did he buy from both?

27. A boy rode on his bicycle $65\frac{2}{3}$ miles on Monday, $72\frac{1}{4}$ miles on Tuesday, and $68\frac{3}{4}$ miles on Wednesday. How many miles must he ride on Thursday to make 250 miles for the four days?

28. A merchant deposited in bank on Monday $\$96\frac{2}{3}$, on Tuesday $\$84\frac{3}{4}$, on Wednesday $\$65\frac{7}{10}$, on Thursday $\$98\frac{1}{4}$. What was the amount of his deposits for the four days?

29. James Price owns a piece of land $46\frac{2}{3}$ rods long, and $38\frac{2}{3}$ rods wide. How many rods of fence will be needed to inclose it?

30. William earned $\$12\frac{2}{3}$, which was $\$16\frac{3}{4}$ less than John earned. How much money did they both earn together?

REVIEW WORK

LESSON 47

1. What is the G. C. D. of 30 and 36?

2. What is a multiple of a number? Of two or more numbers?

3. What is the L. C. M. of two or more numbers?

4. How many feet are $3\frac{1}{8}$ ft., $2\frac{3}{4}$ ft., and $7\frac{1}{2}$ ft.?

5. $\frac{5}{6}$ equals how many 18ths? $\frac{5}{8}$ = how many 40ths?

6. Name the prime factors of 35, 32, 49, 63, 66.

7. Name all the prime numbers to 100.

8. Name all the divisors of 48, 27, 34.

9. What is 1% of 100? 200? 300? \$425? 362 gal.?

10. I bought a knife for 50$\cancel{c}$, and sold it at a gain of 50%. How much did I receive for it?

11. Find 6% of \$500; 8% of \$5000; $\frac{1}{3}$% of \$600.

12. What is 25% of 50? 48? 44? 24? 4? 12? 11? $\frac{1}{2}$? $\frac{1}{4}$?

• **13.** What are prime factors? Composite numbers?

14. Change $\frac{2}{3}$ to 4 equivalent fractions.

15. Change $\frac{1}{4}$ to hundredths. $\frac{1}{2}$ to %. $\frac{1}{10}$ to %. $\frac{7}{10}$ to %. $\frac{4}{5}$ to %.

16. By what number must you multiply both terms of the fraction $\frac{3}{4}$ to change it to $\frac{21}{28}$? Compare $\frac{3}{4}$ with $\frac{21}{28}$.

17. Name three fractions that can be changed to exact 100ths.

Complete the following:

18. $\frac{4}{5} = \frac{}{30}$. $\frac{2}{3} = \frac{}{21}$. $\frac{2}{9} = \frac{}{36}$. $\frac{7}{8} = \frac{}{56}$. $\frac{5}{7} = \frac{}{63}$. $\frac{6}{11} = \frac{}{88}$.

19. What part of a quantity is $16\frac{2}{3}$% of it? What is $16\frac{2}{3}$% of 60 miles?

20. Compare $12\frac{1}{2}$% of 32 with 25% of 16.

21. What % of a quantity is $\frac{1}{3}$ of it? $\frac{2}{6}$ of it? $\frac{1}{2}$ of it?

22. If a man spent $66\frac{2}{3}$% of his money, what % of his money remained?

LESSON 48

1. Find the L. C. M. of 3, 6, 9, 12, and 18.

2. $6\frac{5}{7} + \frac{9}{14} + 101\frac{3}{4} = ?$ $100\frac{13}{24} - 80\frac{13}{32} = ?$

$$14\frac{5}{8} - 7\frac{1}{2} - 3\frac{3}{6} = ?$$

Write in figures:

3. Eighty thousand sixty-four, seventy-two thousand and seventy-two thousandths, nine thousand fourteen and 63 thousandths.

4. Change to improper fractions: $7\frac{11}{13}$, $9\frac{11}{16}$, $89\frac{13}{14}$, $64\frac{7}{11}$.

5. Change to whole or mixed numbers: $\frac{95}{8}$, $\frac{86}{14}$, $\frac{126}{17}$, $\frac{1451}{63}$.

6. Write all the composite numbers from 4 to 100.

7. Write all the prime numbers from 2 to 105.

8. Write three fractions that you can reduce to 6ths.

9. Change to lowest terms: $\frac{32}{48}$, $\frac{49}{56}$, $\frac{35}{105}$, $\frac{40}{160}$, $\frac{75}{225}$.

10. $\dfrac{96 \times 48 \times 94}{16 \times 47 \times 24} = ?$ $\dfrac{94 \times 65 \times 78}{13 \times 47 \times 39} = ?$ $\dfrac{91 \times 77 \times 57}{13 \times 11 \times 19} = ?$

11. Mary had 136 plums, and gave 25% of them to her brother. How many plums had she remaining?

12. Write all the divisors of 40, 54, 72, 110, 112.

13. What is $8\frac{1}{3}$% of $36.72? 840 mi.? 3648 T.?

14. Change to 9ths: $\frac{2}{3}$, $5\frac{1}{3}$, $7\frac{2}{3}$, $\frac{10}{18}$, $\frac{30}{90}$, $\frac{36}{54}$, $16\frac{1}{3}$, $14\frac{2}{3}$.

Express as decimals and as per cents.

15. $\frac{1}{10} = .1 = 10\%$ **20.** $\frac{3}{10} = .3 = 30\%$ **25.** $\frac{12}{10} = 1.2 = 120\%$

16. $\frac{2}{10}$ **21.** $\frac{7}{10}$ **26.** $\frac{15}{10}$

17. $\frac{4}{10}$ **22.** $\frac{5}{10}$ **27.** $\frac{16}{10}$

18. $\frac{8}{10}$ **23.** $\frac{6}{10}$ **28.** $\frac{18}{10}$

19. $\frac{9}{10}$ **24.** $\frac{10}{10} = 1.00 = 100\%$ **29.** $\frac{20}{10}$

MULTIPLICATION

LESSON 49

1. 4 apples + 4 apples = how many apples? 2 times 4 apples = how many apples?

2. $\frac{2}{7} + \frac{2}{7} + \frac{2}{7} =$ how many 7ths? 3 times $\frac{2}{7} =$ how many 7ths? $4 \times \frac{2}{9}$ is read 4 *times* $\frac{2}{9}$; $\frac{2}{9} \times 4$ is read $\frac{2}{9}$ *multiplied* by 4.

3. $\frac{2}{9} \times 4 = ?$ $\frac{2}{7} \times 3 = ?$ $\frac{2}{11} \times 5 = ?$ $\frac{2}{13} \times 6 = ?$
$\frac{3}{8} \times 5 = ?$

4. How much will 4 yards of cloth cost at $\$\frac{7}{8}$ a yard?

If 1 yard is worth $\$\frac{7}{8}$, 4 yards are worth 4 times as much,

$$4 \times \$\tfrac{7}{8} = \$\tfrac{28}{8} = \$3\tfrac{4}{8} = \$3\tfrac{1}{2}.$$

If we had divided the denominator by 4 instead of multiplying the numerator, we should have obtained $\$\frac{7}{2}$, or $\$3\frac{1}{2}$, the same as before.

Thus, $\$\frac{7}{8} \times 4 = \$\frac{7}{8 \div 4} = \$\frac{7}{2} = \$3\frac{1}{2}.$

Therefore a fraction may be multiplied by *multiplying its numerator* or by *dividing its denominator*.

Find products by multiplying the numerators:

5. $\frac{4}{7} \times 3$	**8.** $\frac{3}{11} \times 9$	**11.** $\frac{5}{8} \times 9$	**14.** $\frac{5}{12} \times 7$
6. $\frac{3}{5} \times 4$	**9.** $\frac{5}{8} \times 7$	**12.** $\frac{3}{13} \times 10$	**15.** $\frac{7}{10} \times 6$
7. $\frac{2}{3} \times 8$	**10.** $\frac{6}{7} \times 9$	**13.** $\frac{5}{7} \times 6$	**16.** $\frac{3}{4} \times 11$

Find products by dividing the denominators:

17. $\frac{3}{4} \times 2$	**20.** $\frac{4}{9} \times 3$	**23.** $\frac{12}{14} \times 7$	**26.** $\frac{17}{18} \times 9$
18. $\frac{5}{6} \times 3$	**21.** $\frac{8}{10} \times 5$	**24.** $\frac{11}{15} \times 5$	**27.** $\frac{16}{21} \times 7$
19. $\frac{7}{8} \times 4$	**22.** $\frac{7}{12} \times 6$	**25.** $\frac{9}{35} \times 7$	**28.** $\frac{19}{48} \times 12$

Find products by multiplying the numerators:

29. $\frac{8}{15} \times 7$	**32.** $\frac{14}{23} \times 9$	**35.** $\frac{15}{32} \times 9$	**38.** $\frac{6}{51} \times 21$
30. $\frac{11}{12} \times 9$	**33.** $\frac{18}{29} \times 7$	**36.** $\frac{25}{31} \times 6$	**39.** $\frac{11}{35} \times 16$
31. $\frac{6}{7} \times 13$	**34.** $\frac{7}{25} \times 16$	**37.** $\frac{4}{47} \times 3$	**40.** $\frac{39}{54} \times 8$

Find products by dividing the denominators:

41. $\frac{9}{60} \times 10$	**44.** $\frac{14}{26} \times 2$	**47.** $\frac{21}{52} \times 13$	**50.** $\frac{23}{54} \times 27$
42. $\frac{38}{72} \times 12$	**45.** $\frac{43}{50} \times 25$	**48.** $\frac{28}{100} \times 25$	**51.** $\frac{46}{63} \times 9$
43. $\frac{23}{24} \times 8$	**46.** $\frac{45}{49} \times 7$	**49.** $\frac{37}{150} \times 50$	**52.** $\frac{27}{98} \times 14$

LESSON 50

A factor common to the whole number and the denominator of the fraction should be canceled before the multiplication. For it is evident that canceling a factor common to both before the multiplication, is equivalent to dividing both terms of the resulting fraction after the multiplication. (Lesson 33.)

MODEL. $\dfrac{13 \times \cancel{7}}{\underset{2}{\cancel{14}}} = \dfrac{13}{2}, \ \dfrac{13 \times 7}{14} = \dfrac{91}{14}, \ 7\Big|\dfrac{91}{14} = \dfrac{13}{2}.$

Multiply:

1. $\frac{14}{15} \times 9$ 3. $\frac{27}{35} \times 40$ 5. $\frac{12}{45} \times 20$ 7. $\frac{21}{32} \times 40$

2. $\frac{13}{18} \times 27$ 4. $\frac{5}{44} \times 22$ 6. $\frac{13}{49} \times 14$ 8. $\frac{59}{75} \times 85$

9. Multiply $18\frac{7}{9}$ by 6.

MODEL. $6 \times \frac{7}{9} = \frac{42}{9} = 4\frac{6}{9} = \ 4\frac{2}{3}, \ \text{or} \ 18\frac{7}{9} = \frac{169}{9}.$

$$6 \times 18 = 108$$
$$\overline{112\frac{2}{3}} \qquad \dfrac{169 \times \overset{2}{\cancel{6}}}{\underset{3}{\cancel{9}}} = \dfrac{338}{3} = 112\frac{2}{3} \ Ans.$$

Multiply:

10. $33\frac{1}{8}$ by 6   13. $28\frac{2}{3}$ by 36   16. $17\frac{3}{7}$ by 21

11. $12\frac{1}{2}$ by 8   14. $62\frac{1}{2}$ by 32   17. $26\frac{3}{8}$ by 96

12. $87\frac{1}{2}$ by 16   15. $75\frac{3}{5}$ by 25   18. $32\frac{2}{9}$ by 54

19. How many feet are 6 times $\frac{2}{3}$ of a foot?

20. How many yards are 4 times $\frac{3}{8}$ of a yard?

21. How much will 2 pounds of tea cost at \$$\frac{7}{8}$ a pound?

22. How many feet are 6 times $\frac{3}{4}$ of a yard?

23. At $12\frac{1}{2}$ ¢ a dozen, how much will 8 dozen eggs cost?

24. If 7 men can do a piece of work in $2\frac{5}{7}$ weeks, how long will it take 1 man to do it?

25. How many rods of fence can a man build in 6 days, if he builds $1\frac{2}{3}$ rods in a day?

2. $\frac{2}{7} + \frac{2}{7} + \frac{2}{7} =$ how many 7ths? 3 times $\frac{2}{7} =$ how many 7ths? $4 \times \frac{2}{9}$ is read 4 *times* $\frac{2}{9}$; $\frac{2}{9} \times 4$ is read $\frac{2}{9}$ *multiplied* by 4.

3. $\frac{2}{9} \times 4 = ?$　　$\frac{2}{7} \times 3 = ?$　　$\frac{2}{11} \times 5 = ?$　　$\frac{2}{13} \times 6 = ?$　　$\frac{3}{4} \times 5 = ?$

4. How much will 4 yards of cloth cost at $\$\frac{7}{8}$ a yard?

If 1 yard is worth $\$\frac{7}{8}$, 4 yards are worth 4 times as much,

$$4 \times \$\frac{7}{8} = \$\frac{28}{8} = \$3\frac{4}{8} = \$3\frac{1}{2}.$$

If we had divided the denominator by 4 instead of multiplying the numerator, we should have obtained $\$\frac{7}{2}$, or $\$3\frac{1}{2}$, the same as before.

Thus,　　　　　$\$\frac{7}{8} \times 4 = \$\frac{7}{8 \div 4} = \$\frac{7}{2} = \$3\frac{1}{2}.$

Therefore a fraction may be multiplied by *multiplying its numerator* or by *dividing its denominator*.

Find products by multiplying the numerators:

5. $\frac{5}{7} \times 3$	**8.** $\frac{3}{11} \times 9$	**11.** $\frac{5}{8} \times 9$	**14.** $\frac{5}{12} \times 7$
6. $\frac{3}{5} \times 4$	**9.** $\frac{5}{8} \times 7$	**12.** $\frac{3}{13} \times 10$	**15.** $\frac{7}{10} \times 6$
7. $\frac{4}{3} \times 8$	**10.** $\frac{6}{7} \times 9$	**13.** $\frac{5}{7} \times 6$	**16.** $\frac{3}{4} \times 11$

Find products by dividing the denominators:

17. $\frac{3}{4} \times 2$	**20.** $\frac{4}{9} \times 3$	**23.** $\frac{12}{14} \times 7$	**26.** $\frac{17}{18} \times 9$
18. $\frac{5}{6} \times 3$	**21.** $\frac{8}{10} \times 5$	**24.** $\frac{11}{15} \times 5$	**27.** $\frac{16}{21} \times 7$
19. $\frac{7}{8} \times 4$	**22.** $\frac{7}{12} \times 6$	**25.** $\frac{9}{35} \times 7$	**28.** $\frac{19}{48} \times 12$

Find products by multiplying the numerators:

29. $\frac{8}{15} \times 7$	**32.** $\frac{14}{23} \times 9$	**35.** $\frac{15}{32} \times 9$	**38.** $\frac{6}{51} \times 21$
30. $\frac{11}{12} \times 9$	**33.** $\frac{18}{29} \times 7$	**36.** $\frac{25}{31} \times 6$	**39.** $\frac{11}{35} \times 16$
31. $\frac{6}{7} \times 13$	**34.** $\frac{7}{25} \times 16$	**37.** $\frac{41}{47} \times 3$	**40.** $\frac{39}{54} \times 8$

Find products by dividing the denominators:

41. $\frac{9}{60} \times 10$	**44.** $\frac{14}{26} \times 2$	**47.** $\frac{21}{52} \times 13$	**50.** $\frac{23}{64} \times 27$
42. $\frac{38}{72} \times 12$	**45.** $\frac{43}{50} \times 25$	**48.** $\frac{28}{100} \times 25$	**51.** $\frac{46}{63} \times 9$
43. $\frac{23}{24} \times 8$	**46.** $\frac{45}{49} \times 7$	**49.** $\frac{37}{150} \times 50$	**52.** $\frac{27}{98} \times 14$

LESSON 50

A factor common to the whole number and the denominator of the fraction should be canceled before the multiplication. For it is evident that canceling a factor common to both before the multiplication, is equivalent to dividing both terms of the resulting fraction after the multiplication. (Lesson 33.)

MODEL. $\dfrac{13 \times \cancel{7}}{\underset{2}{\cancel{14}}} = \dfrac{13}{2}, \ \dfrac{13 \times 7}{14} = \dfrac{91}{14}, \ 7\Big|\dfrac{91}{14} = \dfrac{13}{2}.$

Multiply:

1. $\frac{14}{15} \times 9$ 3. $\frac{27}{35} \times 40$ 5. $\frac{13}{45} \times 20$ 7. $\frac{21}{32} \times 40$

2. $\frac{13}{18} \times 27$ 4. $\frac{5}{44} \times 22$ 6. $\frac{13}{49} \times 14$ 8. $\frac{59}{75} \times 85$

9. Multiply $18\frac{7}{9}$ by 6.

MODEL. $6 \times \frac{7}{9} = \frac{42}{9} = 4\frac{6}{9} = \quad 4\frac{2}{3}, \ $ or $\ 18\frac{7}{9} = \frac{169}{9}.$

$$6 \times 18 = 108$$
$$\overline{112\frac{2}{3}} \qquad \dfrac{169 \times \overset{2}{\cancel{6}}}{\underset{3}{\cancel{9}}} = \dfrac{338}{3} = 112\frac{2}{3} \ Ans.$$

Multiply:

10. $33\frac{1}{3}$ by 6   13. $28\frac{2}{3}$ by 36   16. $17\frac{3}{7}$ by 21

11. $12\frac{1}{2}$ by 8   14. $62\frac{1}{2}$ by 32   17. $26\frac{3}{8}$ by 96

12. $87\frac{1}{2}$ by 16   15. $75\frac{3}{5}$ by 25   18. $32\frac{2}{9}$ by 54

19. How many feet are 6 times $\frac{2}{3}$ of a foot?

20. How many yards are 4 times $\frac{3}{8}$ of a yard?

21. How much will 2 pounds of tea cost at $\$\frac{7}{8}$ a pound?

22. How many feet are 6 times $\frac{3}{4}$ of a yard?

23. At $12\frac{1}{2}$¢ a dozen, how much will 8 dozen eggs cost?

24. If 7 men can do a piece of work in $2\frac{5}{7}$ weeks, how long will it take 1 man to do it?

25. How many rods of fence can a man build in 6 days, if he builds $1\frac{3}{8}$ rods in a day?

LESSON 51

1. If a family use $5\frac{5}{6}$ barrels of flour in a year, how many barrels will 8 families use in the same time?

2. There are $24\frac{3}{4}$ cubic feet in a perch of stone. How many cubic feet are there in 8 perches?

3. If a load of hay weighs $\frac{5}{9}$ of a ton, find the weight of 18 loads of the same weight.

4. A coal train moves at the rate of $21\frac{3}{8}$ miles in an hour. How far will it go in 8 hours?

Find the cost of:

        5. 16 yd. of muslin at $6\frac{3}{4}$ ¢.

        6. 8 lb. of pork at $14\frac{1}{2}$ ¢.

        7. 6 bu. of potatoes at $45\frac{3}{4}$ ¢.

        8. 14 bu. of corn at $47\frac{1}{2}$ ¢.

        9. 20 lb. lard @ $9\frac{3}{4}$ ¢.

        10. 12 lb. dried cherries @ $3\frac{3}{4}$ ¢.

        11. 42 lb. sugar @ $6\frac{1}{4}$ ¢.

12. Multiply 36 by $\frac{8}{9}$.

OPERATION

$\frac{1}{9}$ of $36 = 4$,

$\frac{8}{9}$ of $36 = 8 \times 4$, or 32.

36 multiplied by $\frac{8}{9}$ means the same as $\frac{8}{9}$ of 36. Taking $\frac{8}{9}$ of 36, we have 32. Or, by canceling the common factor, 9, from both dividend and divisor, and multiplying the remaining factors, we get 32.

OR

$$\overset{4}{\cancel{36}} \times \frac{8}{\underset{1}{\cancel{9}}} = \frac{32}{1} = 32.$$

Multiply:

13. 36 by $\frac{3}{4}$ **15.** 54 by $\frac{5}{12}$ **17.** 81 by $\frac{17}{18}$ **19.** 78 by $\frac{11}{12}$

14. 45 by $\frac{8}{9}$ **16.** 74 by $\frac{11}{12}$ **18.** 18 by $\frac{13}{20}$ **20.** 180 by $\frac{5}{9}$

21. What is $\frac{3}{4}$ of 160? $\frac{3}{7}$ of 210? $\frac{5}{6}$ of \$24.60?

22. What is $\frac{5}{9}$ of \$1800? $\frac{4}{5}$ of 455 gal.? $\frac{8}{9}$ of 369 in.?

LESSON 52

1. Multiply 27 by $7\frac{8}{9}$.

MODELS.   27   OR, $7\frac{8}{9} = \frac{71}{9}$

 $\frac{7\frac{8}{9}}{}$

$24 = \frac{8}{9}$ times 27

$189 = 7$ times 27

$\overline{213} = 7\frac{8}{9}$ times 27

$$\overset{3}{\cancel{27}} \times \frac{71}{\cancel{9}} = \frac{213}{1} = 213 \ Ans.$$
$$\underset{1}{}$$

Multiply:

2. 36 by $5\frac{4}{9}$	**5.** 60 by $25\frac{4}{5}$	**8.** 27 by $9\frac{5}{8}$
3. 48 by $6\frac{3}{8}$	**6.** 80 by $6\frac{9}{10}$	**9.** 49 by $8\frac{4}{14}$
4. 72 by $7\frac{5}{9}$	**7.** 19 by $6\frac{3}{4}$	**10.** 63 by $7\frac{1}{8}$

11. A man earns \$.45 an hour. At the same rate, how much can he earn in $6\frac{3}{5}$ hours?

12. If a bushel of wheat makes 48 lb. of flour, how many pounds of flour will $12\frac{5}{6}$ bu. make?

13. If 2 men can plow 5 acres of ground in a day, how many acres can they plow in $11\frac{3}{5}$ days?

14. A boy rode 90 miles on his bicycle one day. At the same rate, how far would he ride in $\frac{8}{15}$ of a day?

15. Find the cost of $9\frac{7}{9}$ yd. of cloth at \$2.70 a yard.

16. A man picked 90 bu. of apples in 3 days. At the same rate, how many bushels would he pick in $\frac{13}{15}$ of a day?

17. Find the L. C. M. of 5, 7, 10, 14, 21.

18. Find the G. C. D. of 36, 63, 108.

19. $\frac{2}{3} + \frac{3}{4} + \frac{5}{6} = ?$ $\frac{6}{7} + \frac{11}{12} - \frac{23}{42} = ?$

20. To the sum of $7\frac{7}{8}$ and $18\frac{2}{3}$ add their difference.

21. What is 60% of 450? What is $\frac{3}{5}$ of 450?

LESSON 53

$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	Twelfths
$\frac{1}{3}$				$\frac{1}{3}$				$\frac{1}{3}$				Thirds
$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		Sixths
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	Twelfths

(Get answers from the above diagram.)

1. $\frac{1}{2}$ of $\frac{1}{3}$ = how many 6ths? $\frac{1}{2} \times \frac{1}{3} =$

2. $\frac{1}{2}$ of $\frac{2}{3}$ = how many 6ths? $\frac{1}{2} \times \frac{2}{3} = \frac{}{6}$

3. $\frac{1}{2}$ of $\frac{1}{6}$ = how many 12ths? $\frac{1}{2} \times \frac{1}{6} =$

4. $\frac{1}{2}$ of $\frac{2}{6}$ = how many 12ths? $\frac{1}{2} \times \frac{2}{6} = \frac{}{12}$

5. Compare $\frac{2}{12}$ with $\frac{1}{6}$. $\frac{2}{6}$ with $\frac{1}{3}$. $\frac{4}{12}$ with $\frac{1}{3}$.

6. $\frac{1}{4}$ of $\frac{1}{3}$ = how many 12ths? $\frac{1}{4} \times \frac{1}{3} =$

7. $\frac{3}{4}$ of $\frac{1}{3}$ = how many 12ths? $\frac{3}{4} \times \frac{1}{3} =$

8. $\frac{3}{4}$ of $\frac{2}{3}$ = how many 12ths? $\frac{3}{4} \times \frac{2}{3} = \frac{}{12} = \frac{}{2}$.

9. Multiply $\frac{2}{3}$ by $\frac{3}{4}$.

MODEL. $\frac{1}{4}$ of $\frac{1}{3} = \frac{1}{12}$

        $\frac{1}{4}$ of $\frac{2}{3} = 3$ times $\frac{1}{12} = \frac{3}{12} = \frac{1}{4}$ *Ans.*

To multiply $\frac{2}{3}$ by $\frac{1}{4}$ is practically the same as to find $\frac{1}{4}$ of $\frac{2}{3}$. The word "of" placed between fractions signifies the same as the sign of multiplication. Such expressions as $\frac{1}{4}$ of $\frac{4}{5}$ and $\frac{1}{4}$ of $\frac{5}{6}$ of $\frac{7}{8}$ are called **Compound Fractions.**

10. What is $\frac{1}{2}$ of $\frac{2}{5}$, $\frac{2}{4}$, $\frac{4}{5}$, $\frac{6}{7}$, $\frac{8}{9}$, $\frac{9}{10}$, $\frac{10}{11}$, $\frac{12}{13}$, $\frac{16}{19}$?

11. What is $\frac{1}{3}$ of $\frac{6}{7}$, $\frac{9}{10}$, $\frac{4}{5}$, $\frac{7}{9}$, $\frac{12}{13}$, $\frac{6}{8}$, $\frac{9}{13}$, $\frac{15}{17}$, $\frac{11}{12}$, $\frac{8}{11}$?

12. What is $\frac{3}{8}$ of $\frac{9}{12}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{8}{7}$, $\frac{2}{9}$, $\frac{12}{13}$, $\frac{1}{12}$, $\frac{6}{7}$, $\frac{9}{20}$, $\frac{18}{25}$?

13. Find $\frac{2}{9}$ of $\frac{9}{16}$; $\frac{8}{5}$ of $\frac{10}{11}$; $\frac{4}{5}$ of $\frac{25}{36}$.

14. If 1 gallon of sirup is worth $\$\frac{2}{5}$, how much will $\frac{2}{3}$ of a gallon cost?

15. $\frac{2}{3}$ of $\$\frac{3}{5}$ equals how many cents? $\frac{2}{3}$ of $\$\frac{3}{4}$? $\frac{1}{4}$ of $\$\frac{1}{5}$? $\frac{2}{5}$ of $\$\frac{3}{5}$?

16. Find the product, and then change to %: $\frac{3}{4}$ of $\frac{4}{5}$; $\frac{1}{2}$ of $\frac{6}{10}$; $\frac{3}{4}$ of $\frac{16}{20}$.

LESSON 54

1. Multiply $\frac{5}{12}$ by $\frac{3}{4}$.

MODEL. $\frac{1}{4}$ of $\frac{5}{12} = \frac{1}{4} \times \frac{5}{12} = \frac{5}{48}$

$\frac{3}{4}$ of $\frac{5}{12} = 3 \times \frac{5}{48} = \frac{15}{48} = \frac{5}{16}$ *Ans.*

BY CANCELLATION

$$\frac{5}{\overset{}{\underset{4}{12}}} \times \frac{\overset{1}{3}}{4} = \frac{5}{16} \; Ans.$$

Multiply :

2. $\frac{11}{12}$ by $\frac{6}{7}$ **5.** $\frac{27}{54}$ by $\frac{8}{9}$ **8.** $\frac{27}{84}$ by $\frac{16}{30}$

3. $\frac{21}{40}$ by $\frac{6}{15}$ **6.** $\frac{46}{63}$ by $\frac{7}{23}$ **9.** $\frac{25}{42}$ by $\frac{84}{90}$

4. $\frac{38}{49}$ by $\frac{7}{19}$ **7.** $\frac{51}{72}$ by $\frac{12}{17}$ **10.** $\frac{32}{54}$ by $\frac{27}{64}$

What is the value of :

11. $\frac{2}{3}$ of 2.40? **17.** $\frac{7}{9}$ of $\$6.30$?

12. $\frac{3}{5}$ of 1.20? **18.** $\frac{5}{8}$ of .64?

13. $\frac{5}{12}$ of 132? **19.** $\frac{2}{3}$ of $\frac{5}{6}$ of $\frac{3}{7}$?

14. $\frac{5}{12}$ of 1.32? **20.** $\frac{7}{8}$ of $\frac{8}{9}$ of $\frac{9}{10}$?

15. $\frac{3}{5}$ of 40%? **21.** $\frac{3}{4}$ of $\frac{4}{5}$ of 120%?

16. $\frac{4}{5}$ of 75%? **22.** $\frac{3}{5}$ of $\frac{3}{5}$ of 125%?

3. Change $\frac{3}{4}$ to 36ths. By what number must you multiply both terms of $\frac{3}{4}$ to change it to 36ths? How do you find the number by which you must multiply?

4. How many 36ths are there in 1? In $\frac{1}{4}$? In $\frac{3}{4}$?

5. In changing $\frac{16}{24}$ to 8ths, are the fractional parts larger or smaller? Are there more or less parts?

6. What does the denominator of a fraction show?

7. Name three common divisors of 24 and 36, and tell which is greatest.

8. How many seconds are there in $\frac{4}{5}$ of $2\frac{1}{2}$ minutes?

9. A man has a garden 12 rd. long and 10 rd. wide. How many square rods are in $\frac{2}{3}$ of it? How many square yards are in $\frac{1}{12}$ of it?

10. What are $\frac{3}{4}$ of $2\frac{2}{3}$? $\frac{5}{6}$ of $3\frac{1}{5}$? $\frac{3}{5}$ of $6\frac{1}{4}$? $\frac{5}{7}$ of $4\frac{2}{3}$?

11. A lady bought at one time $2\frac{2}{3}$ yards of tape and at another $3\frac{3}{4}$ yards. How much did it all cost her at 12 ¢ a yard?

12. Minnie bought $\frac{3}{4}$ of a yard of lace and used $\frac{2}{3}$ of it. What part of a yard had she left?

13. A man who owned $\frac{4}{5}$ of $26\frac{2}{3}$ acres of land sold $\frac{3}{4}$ of what he owned. How many acres did he sell?

14. Julia is $15\frac{3}{4}$ years old, and her grandfather is 4 times as old. How old is her grandfather?

LESSON 57

1. What part of a yard is 1 foot? What per cent of a quantity is $\frac{1}{3}$ of it? What per cent of a yard is 1 foot?

2. What part of a yard is 2 feet? What per cent of a quantity is $\frac{2}{3}$ of it? What per cent of a yard is 2 feet?

3. 6 is what part of 24 ?   6 is what per cent of 24 ?

4. What per cent of a day is 6 hr. ?   12 hr. ?   8 hr. ?

5. 25¢ is what part of a dollar ?   25¢ is what per cent of a dollar ?

6. What part of $100 is $25 ? $25 is what per cent of $100 ?

7. 75¢ is what part of $1 ?   75¢ is what per cent of $1 ?

8. 4 is what per cent of 8 ?   12 ?   16 ?   20 ?   24 ? 32 ?

9. If a man bought an article for $12 and sold it for $15, how many dollars did he gain ?   The gain is what part of the cost ?   The gain is what per cent of the cost ?

10. What per cent of a bushel is 8 qt. ?   16 qt. ?

11. A man sold goods that cost $20 for $25.   How much did he gain ?   The gain is what part of the cost ? The gain is what per cent of the cost ?

12. If $4 is $\frac{1}{2}$ of what John paid for a hat, $4 is what per cent of its cost ?

13. If $9 is 50 % of the cost of a coat, find the cost.

14. How many sheets of paper are there in a quire ? 12 sheets are what part of a quire ?   12 sheets are what per cent of a quire ?

DIVISION

LESSON 58

1. If 2 pocket knives cost $$\frac{4}{5}$$, what is the price of one ? What is $\frac{1}{2}$ of $\frac{4}{5}$? $\frac{1}{2} \times \frac{4}{5} = ?$

How do you divide a fraction by an integer (whole number) when the numerator of the fraction is a multiple of the divisor ?

2. What is the cost of 1 book if 4 cost $\$\frac{8}{25}$?

3. If $\$\frac{3}{4}$ is divided equally among 3 boys, what part of a dollar does each receive?

4. If 3 mental arithmetics cost $\$\frac{4}{5}$, what is the price of one? What is $\frac{1}{3}$ of $\frac{4}{5}$? $\frac{1}{3} \times \frac{4}{5} =$?

How do you divide a fraction by an integer when the numerator of the fraction is not a multiple of the divisor?

5. Divide $\frac{8}{9}$ by 4.

MODEL. To divide a number by 4 is to find $\frac{1}{4}$ of it. $\frac{1}{4}$ of $\frac{8}{9} = \frac{2}{9}$.

6. Divide $\frac{8}{9}$ by 2, 3, 4, 5, 6, 7, 8, 9, 10.

7. Divide $\frac{5}{6}$ by 5, 3, 7, 8, 6, 4, 2, 9, 10.

8. How many times is 3 contained in $\frac{3}{8}$? $\frac{2}{3}$? $\frac{6}{7}$? $\frac{9}{11}$? $\frac{4}{5}$? $\frac{12}{13}$? $\frac{5}{6}$? $\frac{7}{8}$? $\frac{15}{16}$?

9. Divide $\frac{12}{13}$ by 6.

$$\text{MODEL.} \quad \frac{12}{13} \div 6 = \frac{1}{\underset{1}{\cancel{6}}} \times \frac{\overset{2}{\cancel{12}}}{13} = \frac{2}{13} \quad Ans.$$

Since dividing a number by 6 is the same as finding $\frac{1}{6}$ of it, we proceed as in multiplication. By canceling the common factor 6, and multiplying, we get $\frac{2}{13}$, the required quotient.

Divide:

10. $\frac{15}{16}$ by 5	**14.** $\frac{21}{25}$ by 7	**18.** $\frac{25}{37}$ by 35
11. $\frac{16}{17}$ by 8	**15.** $\frac{15}{16}$ by 6	**19.** $\frac{46}{51}$ by 23
12. $\frac{18}{19}$ by 9	**16.** $\frac{16}{17}$ by 12	**20.** $\frac{52}{63}$ by 26
13. $\frac{20}{23}$ by 5	**17.** $\frac{49}{56}$ by 63	**21.** $\frac{48}{53}$ by 28

LESSON 59

1. Divide $4\frac{3}{8}$ by 20.

$$\text{MODEL.} \quad 4\frac{3}{8} = \frac{35}{8}.$$

$$\frac{35}{8} \div 20 = \frac{1}{\underset{4}{\cancel{20}}} \times \frac{\overset{7}{\cancel{35}}}{8} = \frac{7}{32} \quad Ans.$$

Divide:

2. $2\frac{5}{6}$ by 6	**5.** $6\frac{2}{5}$ by 12	**8.** $9\frac{3}{5}$ by 24
3. $4\frac{4}{5}$ by 8	**6.** $3\frac{5}{9}$ by 8	**9.** $3\frac{5}{9}$ by 16
4. $1\frac{7}{8}$ by 15	**7.** $4\frac{4}{7}$ by 16	**10.** $4\frac{2}{7}$ by 15

11. If a man paid $\$1\frac{1}{12}$ for 3 bushels of oats, how much was that a bushel?

12. If it takes $43\frac{1}{8}$ yards of cloth to make 5 suits of clothes, how many yards will be needed to make one suit? 12 suits?

13. A boy picked $15\frac{3}{4}$ quarts of berries in 2 hours. At the same rate, how many quarts would he pick in 1 hour? 5 hours?

14. Divide 18 by $\frac{3}{4}$.

> MODEL. $18 \div 1 = 18.$
> $18 \div \frac{1}{4} = 4 \times 18 = 72;$
> $18 \div \frac{3}{4} = \frac{1}{3} \times 72 = 24 \ Ans.$

18 contains 1, 18 times, 18 contains $\frac{1}{4}$, 4 times 18, or 72 times, 18 contains $\frac{3}{4}$, $\frac{1}{3}$ of 4 times 18, or $\frac{1}{3}$ of 18, or $\frac{4}{3} \times 18$, which, by cancellation

$$= \frac{4}{\underset{1}{3}} \times \overset{6}{18} = 24 \ Ans.$$

Therefore, to divide a fraction, we invert the divisor and proceed as in multiplication of fractions.

Divide:

15. 21 by $\frac{7}{8}$	**18.** 28 by $\frac{21}{25}$	**21.** 63 by $\frac{27}{47}$
16. 24 by $\frac{6}{7}$	**19.** 48 by $\frac{20}{29}$	**22.** 72 by $\frac{22}{51}$
17. 27 by $\frac{12}{13}$	**20.** 54 by $\frac{27}{31}$	**23.** 86 by $\frac{43}{56}$

LESSON 60

1. Divide 24 by $6\frac{2}{3}$.

> MODEL. $6\frac{2}{3} = \frac{20}{3}.$ $24 \div \frac{20}{3} = \frac{3}{\underset{5}{20}} \times \overset{6}{24} = \frac{18}{5} = 3\frac{3}{5} \ Ans.$

Divide:

2. 15 by $8\frac{3}{4}$ **5.** 36 by $2\frac{4}{9}$ **8.** 75 by $14\frac{2}{8}$

3. 22 by $9\frac{3}{7}$ **6.** 42 by $5\frac{5}{7}$ **9.** 88 by $16\frac{4}{5}$

4. 20 by $10\frac{5}{8}$ **7.** 54 by $9\frac{3}{8}$ **10.** 44 by $9\frac{2}{7}$

11. Divide $\frac{12}{31}$ by $\frac{6}{7}$.

MODEL. $\frac{12}{13} \div 1 = \frac{12}{13}$; $\frac{12}{13} \div \frac{1}{7} = 7 \times \frac{12}{13} = \frac{84}{13}$;

$$\frac{12}{13} \div \frac{6}{7} = \frac{1}{\cancel{6}_1} \times \frac{\overset{14}{\cancel{84}}}{13} = \frac{14}{13} = 1\frac{1}{13} \ Ans.$$

$\frac{12}{13}$ divided by 1 equals $\frac{12}{13}$; $\frac{12}{13}$ divided by $\frac{1}{7}$ equals 7 times $\frac{12}{13}$, and $\frac{12}{13}$ divided by $\frac{6}{7}$ equals $\frac{1}{6}$ of 7 times $\frac{12}{13}$, or $\frac{7}{6}$ of $\frac{12}{13}$, which, by cancellation,

$$= \frac{7}{\cancel{6}_1} \times \frac{\overset{2}{\cancel{12}}}{13} = \frac{14}{13} = 1\frac{1}{13} \ Ans.$$

Divide:

12. $\frac{5}{8}$ by $\frac{5}{16}$ **14.** $\frac{18}{20}$ by $\frac{6}{13}$ **16.** $\frac{32}{45}$ by $\frac{24}{25}$

13. $\frac{14}{15}$ by $\frac{7}{11}$ **15.** $\frac{25}{36}$ by $\frac{15}{12}$ **17.** $\frac{65}{84}$ by $\frac{26}{63}$

18. Divide $8\frac{3}{4}$ by $\frac{7}{11}$.

MODEL. $8\frac{3}{4} = \frac{35}{4}$.

$$\frac{35}{4} \div \frac{7}{11} = \frac{11}{\cancel{7}} \times \frac{\overset{5}{\cancel{35}}}{4} = \frac{55}{4} = 13\frac{3}{4} \ Ans.$$

Divide:

19. $6\frac{3}{5}$ by $\frac{11}{12}$ **21.** $8\frac{3}{4}$ by $\frac{15}{16}$ **23.** $5\frac{1}{3}$ by $\frac{3}{4}$ **25.** $33\frac{1}{3}$ by $\frac{20}{33}$

20. $7\frac{4}{5}$ by $\frac{13}{14}$ **22.** $9\frac{7}{9}$ by $\frac{22}{27}$ **24.** $3\frac{8}{9}$ by $\frac{1}{2}$ **26.** $40\frac{2}{3}$ by $\frac{61}{93}$

LESSON 61

1. Divide $9\frac{3}{5}$ by $4\frac{2}{3}$.

MODEL. $9\frac{3}{5} = \frac{48}{5}$; $4\frac{2}{3} = \frac{14}{3}$.

$$\frac{48}{5} \div \frac{14}{3} = \frac{3}{\underset{7}{\cancel{14}}} \times \frac{\overset{24}{\cancel{48}}}{5} = \frac{72}{35} = 2\frac{2}{35} \ Ans.$$

Divide:

2. $5\frac{1}{2}$ by $3\frac{1}{8}$ **5.** $4\frac{1}{8}$ by $5\frac{1}{4}$ **8.** $7\frac{1}{8}$ by $5\frac{1}{4}$

3. $3\frac{2}{8}$ by $2\frac{3}{4}$ **6.** $9\frac{3}{4}$ by $2\frac{1}{8}$ **9.** $5\frac{5}{8}$ by $2\frac{5}{8}$

4. $3\frac{1}{2}$ by $4\frac{1}{4}$ **7.** $16\frac{5}{8}$ by $8\frac{1}{2}$ **10.** $12\frac{2}{8}$ by $8\frac{3}{8}$

11. If 2 acres of land yield $75\frac{2}{8}$ bushels of corn, how many bushels will 1 acre yield? 7 acres?

12. If $\frac{3}{4}$ of a farm is worth $1800, how much is the whole farm worth? What is $\frac{5}{12}$ of it worth?

13. If it requires $5\frac{3}{4}$ yards of cloth to make one suit of clothes, how many suits can be made from 69 yards?

14. If 1 chicken weighs $4\frac{3}{4}$ pounds, how many such chickens will weigh $47\frac{1}{2}$ pounds?

15. If a man can save $1\frac{7}{8}$ a day, how long will it take him to save $187\frac{1}{2}$?

16. $41\frac{2}{3}$ equals $\frac{5}{7}$ of the cost of a watch. What is the cost of the watch?

17. At $2\frac{1}{2}$ a yard, how much will $\frac{2}{3}$ of a yard of cloth cost?

18. Find the cost of 1 ton of coal when $3\frac{3}{4}$ tons cost $18\frac{3}{4}$.

19. A man owns a farm containing $62\frac{1}{2}$ acres. If he gives $\frac{1}{8}$ of it to one of his sons, and $\frac{1}{3}$ of it to another, how many acres has he left?

20. 32 is what part of 96?

21. If a farmer raised 96 bushels of buckwheat and sold 32 bushels of it, what per cent did he sell?

LESSON 62

1. How many feet are $\frac{1}{16}$ of 32 rods?

2. From a barrel containing 36 gallons, $\frac{5}{9}$ of the contents was sold. How many gallons were left?

3. How many 9's in 27? What part of 27 is 9? 9 is what per cent of 27?

4. 9 is what part of 45? If 45 yards of carpet cost $50, how much will 9 yards cost?

5. If a man can build ⅝ of a wall in 30 days, in how many days can he build the whole wall?

6. How many rods in ¾ of a mile? In 1¾ miles?

7. From noon till 6 P.M. is what part of a day?

8. What number multiplied by 3⅓ equals 30?

9. If 1½ pecks of beans cost 51¢, how much will 1 quart cost?

10. If a boy earns $½ a day, how long will it take him to earn $7.50?

11. If 6 yards cost 72¢, how many yards can you purchase for $1?

12. If ⅔ of a pound of coffee is worth $⅜, how much is 1 lb. worth?

13. After losing ⅘ of my money I have $380 left. How much money had I at first?

14. How many jars holding ⅔ of a gallon each will be required to hold 24 gallons?

15. If 3 men can do a piece of work in 5⅔ days, how long will it take 1 man to do it? 7 men?

16. At ½ a cent apiece, how many pencils can you buy for $2.50?

17. 62½% of 40 is how many times 12½% of it?

18. ⅚ of a certain number is 50. What is ⅞ of the same number?

LESSON 63

1. A train moves at the rate of 25 miles an hour. How many hours will it take to go 243¾ mi.?

2. Find the sum of $\frac{5}{6}$, $\frac{7}{8}$, and $\frac{3}{4}$ of $\frac{24}{36}$.

3. To $\frac{3}{4}$ of $\frac{5}{6}$ add $\frac{2}{3}$ of $\frac{5}{6}$.

4. If $16\frac{1}{2}$ lb. of sugar cost \$1.15$\frac{1}{2}$, how much is one pound worth?

5. Find the number of square feet in a field $24\frac{1}{4}$ ft. by $30\frac{2}{3}$ ft.

6. Find the cost of $24\frac{3}{4}$ gal. of oil at $37\frac{1}{2}$¢ a gallon.

7. Divide 46 by $\frac{23}{75}$, $8\frac{2}{3}$ by $\frac{13}{27}$, $8\frac{1}{4}$ by $26\frac{7}{10}$.

8. How much will 45 eggs cost at 20¢ a dozen.

9. \$60 is $\frac{7}{8}$ of the cost of a watch. The chain cost $\frac{1}{2}$ as much as the watch. Find the cost of both together.

Find the value of:

10. $\frac{36}{25} \times 15$	**13.** $15\frac{5}{12} \times 15$	**16.** $\frac{3}{5}$ of 75%	**19.** $5\frac{1}{2} \times 5\frac{1}{2}$
11. $4\frac{13}{24} \times 12$	**14.** $18\frac{5}{8} \times 15$	**17.** $\frac{4}{5}$ of 100%	**20.** $2\frac{2}{3} \times 8\frac{1}{4}$
12. $55\frac{5}{6} \times 30$	**15.** $38\frac{3}{4} \times 21$	**18.** $\frac{5}{7}$ of \$2.10	**21.** $2\frac{1}{2} \times 2\frac{1}{2}$

22. Find the cost of $5\frac{1}{2}$ barrels of flour at \$5$\frac{1}{2}$ a barrel.

23. Find the cost of $5\frac{3}{4}$ yd. of linen at 65¢ a yard.

24. Find the cost of $4\frac{3}{4}$ barrels of pork if $\frac{1}{3}$ of a barrel cost \$4$\frac{1}{8}$.

25. How many bushels of potatoes at \$$\frac{5}{8}$ a bushel can you buy for \$125?

26. A farmer sold a merchant two loads of potatoes, one for \$28$\frac{3}{4}$, and the other for \$25$\frac{3}{8}$. If he received \$40.75 in cash, how much is still due him?

RELATION OF QUANTITIES

LESSON 64

1. How many 6's in 18? What part of 18 is 6?

2. If 18 bananas cost 30¢, how much will 6 bananas cost?

3. How many 7's in 21? What part of 21 is 7?

4. If 21 oranges cost 45¢, what is the cost of 7 oranges?

5. How many 8's in 32? What part of 32 is 8?

6. If 32 yards of carpet cost $36, how much will 8 yards cost?

7. What is the relation of 32 to 8?

SUGGESTION. 32 is 4 times 8.

8. What is the relation of 24 to 8? 27 to 9? 45 to 5? 36 to 4? 28 to 7? 40 to 10?

9. What part of 50 % is 25 %? What is the relation of 50 % to 25 %?

10. What is the relation of 9 feet to 3 feet?

11. If 3 oranges cost 7½ ¢, how much will 9 oranges cost?

12. What is the relation of 8 to 32?

SUGGESTION. 8 is ¼ of 32.

13. What is the relation of 6 to 30? 12 to 36? 6 to 42? 9 to 63? 11 to 88?

14. What is the relation of 9 to 12?

SUGGESTION. 9 is $\frac{9}{12}$ or ¾ of 12.

15. What is the relation of 18 to 24? 24 to 18? 24 to 30? 30 to 24?

16. If 18 pencils cost 54 ¢, how much will 24 pencils cost?

MODEL. 24 pencils are $\frac{24}{18}$, or ⅘ of 18 pencils, and cost ⅘ of 54 ¢, or 72 ¢.

17. If a man travels at the rate of 36 miles in 6 hours, how long would it take him to travel 48 miles?

LESSON 65

The relation of one number to another is ascertained by division. When we wish to find *what part* a smaller number is of a larger number, we divide the smaller by the larger. What part of 12 is 4? $4 \div 12 = \frac{4}{12}$, or $\frac{1}{3}$. Therefore 4 is $\frac{1}{3}$ of 12. But when we wish to find how *many times* a smaller number equals a larger, we divide the larger by the smaller. 12 is how many times 4? $12 \div 4 = 3$. Therefore 12 is 3 times 4.

1. What part of 16 is 4?

MODEL. $4 \div 16 = \frac{4}{16}$, or $\frac{1}{4}$. Therefore 4 is $\frac{1}{4}$ of 16.

What part of :

2. 48 is 12? **4.** 96 is 8? **6.** 108 is 42? **8.** 162 is 54?

3. 48 is 18? **5.** 72 is 9? **7.** 144 is 12? **9.** 123 is 36?

10. 40 is how many times 8? How many times 10?

11. 84 is how many times 8? How many times 24?

12. What is the relation of 126 to 84? 132 to 22? 72 to 108? 84 to 56?

13. If 56 buggies cost $4200, find the cost of 84.

SUGGESTION. $84 = \frac{84}{56}$, or $\frac{3}{2}$ of 56.

14. How much will 120 head of cattle cost, if 15 cost $525?

15. If 39 pocket knives cost $33.15, how much will 26 cost?

16. What is the relation of 20¢ to 35¢? $12\frac{1}{2}$¢ to 25¢? $8\frac{1}{3}$¢ to 25¢? $33\frac{1}{3}$¢ to $1? $2 to 25¢? $3 to 75¢?

LESSON 66

1. What is the relation of 1 foot to a yard? What is the relation of a yard to a foot?

2. What is the relation of an inch to a foot? What is the relation of a foot to an inch?

3. If 17 bu. of wheat cost $10, how many bushels can you buy for $25?

SUGGESTION. $25 = $\frac{25}{10}$, or $\frac{5}{2}$ of $10.

4. If 8 men can do a piece of work in 3 days, how long will it take 2 men to do $\frac{1}{2}$ of the work?

5. What is the relation of $\frac{2}{3}$ of 18 to $\frac{3}{4}$ of 36?

6. $33\frac{1}{3}\%$ of 27 is what part of 81? 108?

7. What is the relation of a mile to 120 rods?

8. What is the relation of $8\frac{1}{3}\%$ to $16\frac{2}{3}\%$?

9. What per cent of a quantity is $\frac{2}{6}$ of it? $\frac{5}{6}$ of it?

10. What is the relation of 2 bushels to 6 pecks?

11. If 2 bushels of corn are worth $1.60, how much are 6 pecks worth?

12. What part of a day is 10 hr.? What is the relation of a day to 10 hr.?

13. What part of a mile is 40 rd. What per cent of a mile is 40 rd.?

14. There are 60 pupils in a school, and 45% of them are boys. How many are girls?

15. $62\frac{3}{4} + 9\frac{3}{5} = ?$ $80 \div \frac{5}{6} = ?$ $80 \div \frac{4}{5} = ?$ $75 \div 1\frac{1}{2} = ?$

16. If 36 doz. oranges cost $10.80, how much will 48 doz. cost?

17. What is the relation of the G. C. D. of 18, 24, and 36 to the L. C. M. of 12, 20, 30?

DECIMALS

In decimals, as in whole numbers, the value of a figure depends upon its position. Thus, in .555, the second 5 is $\frac{1}{10}$ of the value of the first 5, and the third 5 is $\frac{1}{10}$ of the value of the second 5, and $\frac{1}{100}$ of the value of the first 5. Or, the first 5 is 10 times the value of the second 5, and 100 times the value of the third 5.

1. In the number 55.55, the first 5 at the left of the decimal point represents how many units? The second 5 at the left represents how many units? How many tens? The second 5 at the left of the point is how many times the value of the first 5 at the left?

2. The first 5 at the right of the point in the number 5.55 is what part of the value of the first 5 at the left of the point? The second 5 at the right of the point is what part of the value of the first 5 at the right?

3. In $543.27, the 5 represents *five* times how many dollars? The 4 represents *four* times how many dollars? The 3 represents *three* times how many dollars? The 2 represents *two* times what part of a dollar? The 7 represents *seven* times what part of a dollar?

4. In 4.56 rods, what does the 4 stand for? What does the 5 stand for? The 6?

5. Compare the values of the 3's in 33, 3.3, .33, .333.

6. In the number 555.555, state the value of each figure as compared with the others, commencing at the left.

7. State the number of tenths, hundredths, and thousandths in each of the following: .538, .608, .004, .400.

REDUCTION

LESSON 68

Read:

1. .8 　　　　4. 32.04 　　　　7. 300.764

2. 4.8 　　　　5. 28.607 　　　　8. 672.009

3. 4.26 　　　6. 90.901 　　　　9. 306.3067

Express in decimal form:

10. $\frac{29}{100}=.29$ 　13. $\frac{29}{1000}=.029$ 　16. $\frac{726}{1000}$ 　19. $\frac{81}{10000}$

11. $\frac{76}{100}$ 　14. $\frac{162}{1000}$ 　17. $\frac{3964}{10000}$ 　20. $\frac{384}{10000}$

12. $\frac{84}{100}$ 　15. $\frac{709}{1000}$ 　18. $\frac{36}{10000}$ 　21. $\frac{956}{100000}$

Express in fractional form:

22. $.4=\frac{4}{10}$ 　25. $.05=\frac{5}{100}$ 　28. .005 　31. .90006

23. .28 　26. .65 　29. .0007 　32. .01061

24. .98 　27. .061 　30. .0906 　33. .05061

Express in decimal form: 　Express in fractional form:

34. $5\frac{3}{10}=5.3$ 　38. $146\frac{7}{1000}$ 　42. $8.4=8\frac{4}{10}$ 　46. 92.031

35. $8\frac{7}{10}$ 　39. $416\frac{128}{10000}$ 　43. 7.7 　47. 124.107

36. $9\frac{3}{100}$ 　40. $169\frac{3081}{100000}$ 　44. 29.36 　48. 167.0101

37. $27\frac{47}{100}$ 　41. $326\frac{8001}{100000}$ 　45. 84.002 　49. 240.0081

LESSON 69

Annexing ciphers to the right of a decimal does not change the value of the decimal. Thus,

$$.5 = \tfrac{5}{10}; \quad .50 = \tfrac{50}{100} = \tfrac{5}{10}; \quad .500 = \tfrac{500}{1000} = \tfrac{5}{10}.$$

1. Change .35 to a common fraction in its lowest terms.

MODEL. $.35 = \frac{35}{100} = \frac{7}{20}$ Ans.

2. .45 　4. .55 　6. .125 　8. .008 　10. .0065

3. .48 　5. .75 　7. .045 　9. .0125 　11. .0075

12. Change 8.05 to a mixed number in its simplest form.

MODEL. $8.05 = 8\frac{5}{100} = 8\frac{1}{20}$ *Ans.*

13. 7.25	**15.** 7.03	**17.** 8.005	**19.** 9.0055
14. 8.35	**16.** 9.48	**18.** 7.105	**20.** 7.1005

21. Change $.4\frac{4}{5}$ to a common fraction in its lowest terms.

$$\text{MODEL.} \quad .4\frac{4}{5} = \frac{4\frac{4}{5}}{10} = \frac{\overset{12}{\cancel{24}}}{\underset{5}{\cancel{10}}} = \frac{1}{\cancel{10}} \times \frac{\cancel{24}}{5} = \frac{12}{25} \ Ans.$$

22. $.6\frac{1}{4}$	**24.** $.08\frac{1}{3}$	**26.** $.16\frac{2}{3}$	**28.** $.37\frac{1}{2}$	**30.** $.66\frac{2}{3}$
23. $.06\frac{1}{4}$	**25.** $.12\frac{1}{2}$	**27.** $.33\frac{1}{3}$	**29.** $.62\frac{1}{2}$	**31.** $.87\frac{1}{2}$

32. Change $9.8\frac{3}{4}$ to a mixed number in its simplest form.

$$\text{MODEL.} \quad .8\frac{3}{4} = \frac{8\frac{3}{4}}{10} = \frac{\overset{7}{\cancel{35}}}{\underset{2}{\cancel{10}}} = \frac{1}{\cancel{10}} \times \frac{\cancel{35}}{4} = \frac{7}{8}. \quad 9 + \frac{7}{8} = 9\frac{7}{8} \ Ans.$$

33. $9.6\frac{2}{3}$	**35.** $8.7\frac{1}{2}$	**37.** $9.37\frac{1}{2}$	**39.** $12.0\frac{4}{5}$
34. $7.01\frac{2}{3}$	**36.** $7.08\frac{3}{4}$	**38.** $17.16\frac{2}{3}$	**40.** $13.10\frac{2}{3}$

LESSON 70

1. Change $\frac{3}{8}$ to a decimal.

$\frac{3}{8}$ is the same as $\frac{1}{8}$ of 3.   OPERATION. $\frac{3}{8} = \frac{1}{8}$ of $3 = 8)\overline{3.000}$
$.375$ *Ans.*

3 units = 30 tenths. $\frac{1}{8}$ of 30 tenths = 3 tenths and 6 tenths remaining. 6 tenths = 60 hundredths, $\frac{1}{8}$ of 60 hundredths = 7 hundredths and 4 hundredths remaining. 4 hundredths = 40 thousandths, $\frac{1}{8}$ of 40 thousandths = 5 thousandths. Hence $\frac{3}{8}$, when reduced to the decimal form, = 3 tenths + 7 hundredths + 5 thousandths, or .375.

Frequently the division will not terminate, and the common fraction cannot be exactly expressed decimally.

In such cases the remainder is usually expressed by a common fraction. Thus, $\frac{2}{7} = 2 \div 7 = .285\frac{5}{7}$.

Change to decimals:

2. $\frac{1}{2}$ 5. $\frac{3}{4}$ 8. $\frac{7}{8}$ 11. $\frac{1}{40}$ 14. $\frac{81}{125}$ 17. $\frac{101}{250}$ 20. $\frac{216}{400}$

3. $\frac{1}{5}$ 6. $\frac{1}{8}$ 9. $\frac{7}{20}$ 12. $\frac{21}{40}$ 15. $\frac{11}{400}$ 18. $\frac{141}{400}$ 21. $\frac{175}{360}$

4. $\frac{1}{4}$ 7. $\frac{5}{8}$ 10. $\frac{3}{8}$ 13. $\frac{9}{25}$ 16. $\frac{15}{16}$ 19. $\frac{171}{500}$ 22. $\frac{125}{650}$

Memorize the decimal equivalents of the following common fractions:

23. $\frac{1}{2} = .5$ 29. $\frac{2}{5} = .4$ 35. $\frac{3}{8} = .37\frac{1}{2}$

24. $\frac{1}{3} = .33\frac{1}{3}$ 30. $\frac{3}{5} = .6$ 36. $\frac{5}{8} = .62\frac{1}{2}$

25. $\frac{2}{3} = .66\frac{2}{3}$ 31. $\frac{4}{5} = .8$ 37. $\frac{7}{8} = .87\frac{1}{2}$

26. $\frac{1}{4} = .25$ 32. $\frac{1}{6} = .16\frac{2}{3}$ 38. $\frac{1}{12} = .08\frac{1}{3}$

27. $\frac{3}{4} = .75$ 33. $\frac{5}{6} = .83\frac{1}{3}$ 39. $\frac{5}{12} = .41\frac{2}{3}$

28. $\frac{1}{5} = .2$ 34. $\frac{1}{8} = .12\frac{1}{2}$ 40. $\frac{1}{16} = .06\frac{1}{4}$

LESSON 71

1. Change to decimals: $\frac{2}{25}$, $\frac{25}{32}$, $\frac{17}{64}$, $\frac{1}{32}$, $\frac{18}{75}$, $\frac{3}{16}$, $\frac{7}{125}$.

2. Change to common fractions in simplest form: .36, .44, .96, .096, .816, .486, .375.

3. Change to decimal form: $\frac{49}{100}$, $\frac{6}{1000}$, $\frac{806}{1000}$, $\frac{364}{10000}$.

4. Express in decimal form: $7\frac{8}{10}$, $29\frac{3}{100}$, $46\frac{9}{100}$, $28\frac{608}{1000}$.

5. Express as common fractions in lowest terms: $.6\frac{4}{5}$, $.8\frac{4}{5}$, $.212\frac{1}{2}$, $.087\frac{1}{2}$, $.433\frac{1}{3}$.

6. Change to mixed numbers in simplest form: $8.5\frac{1}{2}$, $9.05\frac{1}{4}$, $6.3\frac{1}{10}$, $16.18\frac{1}{4}$, $7.00\frac{1}{2}$, $5.16\frac{3}{4}$.

7. Name the *numerators* of the following decimals: .5, .06, .54, .004, .406, .362, .0006, .0042.

8. Name the denominators of the following decimals: .8, .05, .63, .007, .309, .532, .0009, .0076, .1$\frac{1}{3}$, .06$\frac{1}{4}$, .66$\frac{2}{3}$, .501$\frac{1}{8}$, .6430$\frac{1}{7}$.

9. Read: .50106, 9.20, .020, 90.0057, 500.005 .00600, 2.0002, .2222, .02002.

10. $\frac{1}{5}$ of 4 equals how many tenths?

11. $.7\frac{1}{2}$ = how many hundredths? $\frac{1}{2}$ = how many hundredths?

12. State the value of each in hundredths: $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{1}{5}$, $\frac{3}{5}$, $\frac{5}{8}$, $\frac{1}{12}$, $\frac{5}{12}$, $\frac{7}{12}$, $\frac{1}{16}$, 8%, $3\frac{1}{3}\%$, $.3\frac{1}{3}$, $37\frac{1}{2}\%$, $62\frac{1}{2}\%$, $6.2\frac{1}{2}$.

ADDITION
LESSON 72

1. Find the sum of 18.3, .04, 2.106, and .0051.

Since only similar units can be added, we write *tenths* in *one* column, *hundredths* in another, and *thousandths* in another, etc., and add and carry as in whole numbers.

OPERATION

18.3
.04
2.106
.0051
———
20.4511 *Ans.*

Find the sum of:

2. 3.42, .006, .41, 46.81, and 281.004.

3. .08, 1.641, 1.71, 72.301, 463.1, and .0004.

4. 1.665, .3842, 78.005, .5101, 84.3, and 91.91.

5. .006, 4.001, 3.8406, .004, 9.2, and .31365.

6. Find the sum of 8 tenths, twenty-one hundredths, 16 thousandths, 31 ten-thousandths, 62 millionths.

7. Find the sum of 9, and 3 tenths; 42, and 16 hundredths; 33 thousandths; 18, and 5 thousandths; 21, and 21 ten-thousandths; 160, and 316 ten-thousandths.

8. Write and add: six thousand, and six thousandths; seven hundred five, and seventeen hundredths; ninety, and nine millionths; eight hundred forty hundred-thousandths.

Add :

9.	10.	11.	12.
$.37\frac{1}{2}$	$1.06\frac{3}{4}$	$3.08\frac{1}{3}$	$\$500.62\frac{1}{2}$
$.35$	$.24\frac{1}{2}$	$.66\frac{2}{3}$	$50.33\frac{1}{3}$
$.62\frac{1}{2}$	$.96\frac{5}{8}$	$.72\frac{3}{4}$	$725.00\frac{2}{3}$
$7.87\frac{1}{2}$	$.83\frac{3}{4}$	4.38	$3.12\frac{1}{2}$
$5.08\frac{1}{4}$	$1.36\frac{1}{4}$	$.68\frac{3}{8}$	$.08\frac{1}{2}$

SUBTRACTION

LESSON 73

1. From 92.61 take 84.006.

The minuend and subtrahend are written so that units of the same order stand in the same column. When the number of decimal places in the subtrahend exceeds the number in the minuend, ciphers are generally annexed to the minuend to make them equal.

OPERATION

92.610
84.006
———
8.604 *Ans.*

Subtract :

2. 18.03 from 32.06

3. .0101 from 29.1

4. 260.009 from 381.064

5. 38.406 from 182.606

6. 1.666 from 3.009

7. .8460 from 9.4

8. 3.8749 from 16.001

9. 4.9999 from 5.0014

10. .99999 from 1.1

11. 5.00001 from 6.09

12. $\$10 - \$2.87\frac{1}{2} = ?$

13. $\$8 = \$7.99\frac{1}{2} = ?$

14. $\$100 - \$.62\frac{1}{2} = ?$

15. $400 - .66\frac{2}{3} = ?$

16. $.301 - .25\frac{3}{4} = ?$

17. $340.1 - 96 - 9 = ?$

18. From 4 hundred and 4 hundredths take 399 and 99 hundredths.

19. From 6060 and 606 millionths take 24 and 79 ten-thousandths.

20. From 6.05 take 4.0075. From 1.1 take .9099.

21. Mr. Bright who owned 160.8 acres of land, sold $13\frac{1}{8}$ acres at one time and 16.004 at another time. How many acres had he left?

22. From the sum of 13.5 and 8.7 take their difference.

23. How many tons are there in $18\frac{3}{4}$ tons $+ 16.8$ tons $+ 66\frac{2}{3}$ tons $+ 9\frac{3}{4}$ tons?

MULTIPLICATION

LESSON 74

1. $\frac{1}{10} \times \frac{1}{10} = \frac{1}{100} = .01$; or, $.1 \times .1 = .01$.

2. $\frac{7}{10} \times \frac{3}{10} = \frac{21}{100} = .21$; or, $.7 \times .3 = .21$.

3. $\frac{3}{10} \times \frac{9}{100} = \frac{27}{1000} = .027$; or, $.3 \times .09 = .027$.

4. $\frac{8}{100} \times \frac{7}{100} = \frac{56}{10000} = .0056$; or, $.08 \times .07 = .0056$.

5. $\frac{5}{10} \times 7 = \frac{35}{10} = 3.5$; or, $.5 \times 7 = 3.5$.

6. Multiply 3.2 by 2.4.

OPERATION

$$3.2$$

EXPLANATION

$$2.4$$

$3.2 = 3\frac{2}{10} = \frac{32}{10}$

$$\overline{128}$$

$2.4 = 2\frac{4}{10} = \frac{24}{10}$

$$64$$

$$\tfrac{32}{10} \times \tfrac{24}{10} = \tfrac{768}{100} = 7\tfrac{68}{100} = 7.68 \; Ans.$$

It will be seen from the preceding exercises that we multiply decimals like whole numbers, and point off from the right of the product as many decimal places as there are in the multiplicand and multiplier together, prefixing ciphers when the number of figures in the product does not equal the number of decimal places in both factors.

Multiply :

7. 8.06 by .04   **10.** 1.01 by .002   **13.** .001 by 1.1

8. 24.38 by 1.65   **11.** 30.03 by 28.3   **14.** $4\frac{1}{2}$ by .001

9. .004 by 3.02   **12.** 161.3 by .401   **15.** $3.2\frac{1}{4}$ by $.01\frac{1}{2}$

16. How many tons are there in 36 loads of coal, each load weighing 1.8 tons?

17. What must be paid for 33.6 tons of coal at $3.75 a ton?

18. Find the cost of 8.384 thousand feet of boards at $13.35 per thousand.

DIVISION

LESSON 75

1. Divide 1282.56 by 76.8.

As the dividend is the product of the divisor and quotient, the number of decimal places in the dividend should equal the number in the divisor and quotient taken together.

Since there are *two* decimal places in the dividend and *one* in the divisor, there must be the difference between *two* and *one*, or *one* decimal place in the quotient.

OPERATION

```
76.8)1282.56(16.7
     768
     5145
     4608
     5376
     5376
```

2. Divide 136.318 by 3.185.

When there is a remainder, ciphers may be annexed to the dividend and the division continued as shown in the operation.

When the division will not terminate, and an exact quotient cannot be expressed decimally, the remainder may be expressed by a common fraction; or, when a number of decimal places sufficient for practical purposes has been obtained, the sign "+" may be annexed to indicate that the division is not complete. (See operations following.)

OPERATION

```
3.185)136.3180(42.8 Ans.
      12740
       8918
       6370
      25480
      25480
```

3. Divide 29.62 by 24.

OPERATION

24)29.62(1.23$\frac{5}{12}$ *Ans.*
24

56
48

82
72

$\frac{10}{24} = \frac{5}{12}$

4. Divide 56.285 by 6.3.

OPERATION

6.3)56.2850(8.934+ *Ans.*
504

588
567

215
189

260
252

5. Divide 16.384 by .00256.

When the number of decimal places in the divisor exceeds the number in the dividend, we make them equal by annexing ciphers to the dividend.

OPERATION

.00256)16.38400(6400 *Ans.*
1536

1024
1024

00

6. Divide .054 by 28.8.

Sometimes ciphers must be prefixed to the quotient figures in order to make the number of decimal places equal the excess of the number in the dividend over the number in the divisor.

OPERATION

28.8).0540000(.001875 *Ans.*
288

2520
2304

2160
2016

1440
1440.

LESSON 76

Divide:

1. 21.872 by .32

2. 1.367 by .02

3. 2579.85 by 409.05

4. .21512 by 70.35

5. 21.3615 by 3.15   **11.** 11.52 by .0096

6. 2.13615 by 31.5   **12.** 62.125 by .0007

7. 24 by .032   **13.** .231 by .0654

8. .819873 by 184.5   **14.** 6.72 by .175

9. 9.6 by .00032   **15.** .25 by 3.1416

10. 819.873 by 18.45   **16.** .0356 by .754

Find the value of:

17. $2.32 \times .012 \times .08$ **20.** $62.5 \div 2.5$

18. $3.8 \times .0225 \times .5$ **21.** $42 \div .007$

19. $3.22 \times 50 \times .3 \times \frac{1}{4}$ **22.** $126 \div .63$

23. $9.33 \times .33\frac{1}{3}$ **24.** $1.66\frac{2}{3} \div 33\frac{1}{3}$ **25.** $.83\frac{1}{3} \div .08\frac{1}{3}$

26. At $2.75 a pair, how many pairs of skates can be bought for $1100?

27. I paid $41.715 for 30.9 yards of carpet. How much did I pay for 1 yard?

28. At $.37$\frac{1}{2}$ per bushel, how many bushels of oats can be bought for 13.12\frac{1}{2}$?

29. At 38¢ a yard, how many yards of ribbon can be bought for $9671?

30. At the rate of 48.875 miles a day, how many days will it take a man to ride on his bicycle a distance of 281.03125 miles?

LESSON 77

1. How much will 350 celery plants cost at 30¢ a hundred?

2. Find the cost of 36 articles at 25¢, 20¢, 12$\frac{1}{2}$¢, 33$\frac{1}{3}$¢, $\frac{3}{4}$, 50¢.

3. At $12\frac{1}{2}$¢ a pound, how many pounds of cheese can be bought for $2? 50¢? $62\frac{1}{2}$¢? $87\frac{1}{2}$¢?

4. Find $.62\frac{1}{2}$ of 160 yards. $62\frac{1}{2}$% of $1.60.

5. 100 times a certain number is 425. Find the number.

6. What part of .8 is .2? What part of .8 is .08?

7. The multiplicand has 3 decimal places, and the multiplier has 2. How many decimal places are there in the product?

8. What part of .4 is .25? Change .2 of a day to hours.

9. If .3 of a yard of ribbon is worth 6¢, how much is 1 yard worth? 2.5 yards?

10. 1 equals how many hundredths? .1 equals how many hundredths? .2 equals how many hundredths?

11. If 36¢ is the difference between .2 and .02 of a boy's money, how much money has he?

12. What decimal of a day is 2 hr.? 3 hr.? 4 hr.? 6 hr.?

13. The product has 6 decimal places, and the multiplier 2. How many decimal places has the multiplicand?

14. What part of 3.2 is .16? Reduce .1 of a day to hours.

LESSON 78

1. If 10 tons of coal cost $10.50, how much will 7.6 tons cost?

2. If 9.3 yd. of cloth cost $20.925, find the cost of 90.3 yd.

3. Find the sum of $.16\frac{2}{3}$, $25.12\frac{1}{2}$, $8\frac{1}{4}$, $.6\frac{1}{4}$, $16\frac{2}{3}$, $66\frac{2}{3}$, $.66\frac{2}{3}$, and $.62\frac{1}{2}$.

In business transactions C is frequently used to denote *one hundred*, and M *one thousand*.

4. How much will 4386 pounds of freight cost at $.875 per C.

To change a number to hundreds, we divide it by 100, which is the same as pointing off two places at the right. Since *one hundred* pounds cost $.875, 43.86 hundreds will cost 43.86 times $.875.

OPERATION

$4386 \div 100 = 43.86$ hundreds

$43.86 \times \$.875 = \$38.377$ *Ans.*

5. Find the cost of 248 fence posts at $17.33⅓ per C.

6. Find the cost of 731 pounds of buckwheat flour at $2.35 a hundred.

7. Find the cost of 2625 cabbages at $4.62½ per C.

Find the value of :

8. $1.08\frac{1}{3} \times 12$	**13.** $84 \div .07$	**18.** $200 - .66\frac{2}{3}$
9. $1.12\frac{1}{2} \times 24$	**14.** $84 \div .007$	**19.** $200 \times .002$
10. $.06\frac{1}{4} \times 36$	**15.** $840 \div .7$	**20.** $.66\frac{2}{3} \div .33\frac{1}{3}$
11. $.87\frac{1}{2} \times 18$	**16.** $2 \div .008$	**21.** $10 \div .001$
12. $1.66\frac{2}{3} \times 66$	**17.** $12.6 \div .063$	**22.** $9 \times .009$

LESSON 79

1. Find the cost of 5385 bricks at $4.25 per M.

To change a number to thousands, we divide it by 1000, which is the same as pointing off three places at the right. Hence 5385 = 5.385 thousands. 5.385 thousands will cost 5.385 times $4.25, or $22.886.

OPERATION

$5385 \div 1000 = 5.385$ thousands

$5.385 \times \$4.25 = \$22.886$ *Ans.*

2. Find the cost of 8584 feet of boards at $13.50 per M.

3. Find the cost of 45,380 shingles at $3.50 per M.

4. Find the cost of 3660 envelopes at $2.33⅓ per M.

5. Find the cost of 16,850 shad at $80 per M.

6. Find the cost of 6400 pounds of hay at $16.50 per ton.

2000 pounds make a ton. Hence, to change pounds to tons we divide the number representing the quantity by 2000, which is the same as pointing off

OPERATION

6400 ÷ 2000 = 3.2 tons

3.2 × $16.50 = $52.80 *Ans.*

three places at the right for decimals, and dividing by 2. 6400 pounds = 3.2 tons. Hence the cost = 3.2 times $16.50, or $52.80 *Ans.*

7. Find the value of 3200 pounds of guano at $50 a ton.

8. Find the cost of 8940 pounds of coal at $3.75 a ton.

9. If .75 of a ton of clover hay is worth $12.60, how much is a ton worth?

REVIEW WORK

LESSON 80

1. What part of a quantity is $33\frac{1}{3}$% of it? What is $33\frac{1}{3}$% of $21? 42 yards? $9\frac{2}{5}$ bushels? $12\frac{6}{7}$ gallons?

2. If a man walks $14\frac{2}{5}$ miles in 4 hours, at what rate does he walk per hour?

3. What is the cost of a bushel of potatoes if 13 bushels cost $8\frac{2}{3}$? 5 bu.? $7\frac{1}{2}$ bu.?

4. If $3\frac{3}{4}$ dozen eggs cost $.60, how much will 20 eggs cost?

5. If 8 oz. of butter are worth 16¢, how much must I pay for 5 pounds, 5 oz.?

6. If 6 men can do a piece of work in 8 days, how long will it take them to do $\frac{3}{4}$ of the work? How many days will it take 3 men to do $\frac{1}{2}$ of the work?

7. What is a fraction? A decimal fraction? An improper fraction?

8. I bought $\frac{7}{8}$ of a gallon of ink at 20¢ a pint. How much did it cost?

9. Change to lowest terms: $\frac{9}{15}$, $\frac{6}{14}$, $\frac{18}{27}$, $\frac{30}{36}$, $\frac{24}{48}$, $\frac{40}{48}$, $\frac{40}{50}$.

10. If $2\frac{1}{2}$ lb. of sugar cost 15¢, how many pounds can you buy for $1.12?

11. What per cent of a quantity equals $\frac{1}{2}$ of the quantity?

12. What per cent of 8 is 4? What per cent of 32 is 8?

13. What is the relation 16 to 8? 30 to 5? $\frac{3}{4}$ to $\frac{1}{4}$?

14. If 16 collars are worth 80¢, how much are 8 collars worth?

15. What per cent of a quantity equals the quantity?

16. What per cent of 2 is 2? Of $\frac{1}{2}$ is $\frac{1}{2}$? Of $\frac{2}{3}$ is $\frac{2}{3}$? Of $\frac{3}{8}$ is $\frac{1}{8}$? Of $\frac{8}{9}$ is $\frac{2}{9}$?

17. I spent $\frac{1}{3}$ and $\frac{1}{5}$ of my money. What part of my money remains?

18. How many yards are $5\frac{1}{4}$ yd. and $7\frac{1}{4}$ yd.?

19. $5\frac{3}{4}$ inches and how many inches make $1\frac{1}{2}$ feet?

LESSON 81

1. A carpenter worked $8\frac{1}{2}$ hours Monday, 9 hours Tuesday, $7\frac{3}{4}$ hours Wednesday, 8 hours Thursday, 6 hr. 40 min. Friday, and 7 hr. 30 min. Saturday. If 8 hours' work make a day, how much did he earn during the week at $2.88 a day?

2. Find the G. C. D. of 42, 56, 63, and 91.

3. If $.87\frac{1}{2}$ bushel of corn sells for 56¢, how much is a bushel worth? $5\frac{3}{8}$ bushels?

4. Find the sum of .85, $.83\frac{1}{3}$, $.87\frac{1}{2}$, $25.66\frac{2}{3}$.

5. $7\frac{3}{4} + .12\frac{1}{2} + .08\frac{1}{3} + 6\frac{1}{4} + 6.66\frac{2}{3} + .4 + 100\frac{1}{2} = ?$

Find the cost of :

6. 24 bbl. flour at $4⅝ a barrel.

7. 15 lb. 8 oz. butter at $.37½ a pound.

8. 25 rockers at $1⅞ apiece.

9. 3½ doz. common chairs at 69¢ apiece.

10. 19½ yd. flannel at 37½¢ a yard.

11. 360 pineapples at 96¢ a dozen.

12. 800 pineapples at $12.37½ per C.

13. 36,800 lb. iron at $21¾ per ton.

14. 7864 ft. lumber at $12⅗ per M.

15. 9648 lb. plaster at 47½¢ per C.

16. 35.85 acres of land at $55⅞ per acre.

LESSON 82

1. If a man earned $1277½ in 365 days, how much was that per day ?

2. If 27 lb. 12 oz. of candy are divided among 6 persons, how many pounds and ounces does each person receive ?

3. From a pile of corn containing 40 bushels there were sold 20.75 bushels. How many bushels and pecks remained ?

4. J. R. Rudolph bought of Kropp & House the following goods :

May 18, 1900 : 8 lb. granulated sugar, at 6¼¢; 4 lb. tea, at 87½¢. May 19 : 5½ lb. coffee, at 35¢; 2 lb. 4 oz. ham, at 14¢; 4 chickens (16 lb. 11 oz.), at 12¢ per pound. May 23 : 25 bananas, at 15¢ a dozen ; 18½ yd. silk, at $1.35 ; 12 yd. linen, at 87½¢.

Make out the above bill, using Form 2, Lesson 87.

5. At $1.87½ a pair, how many pairs of skates can I get for $30?

6. At what price must coats that cost $8 be sold to gain 50%? 12½%? 25%? 62½%?

7. If ¾ of 36 bananas cost 36¢, how much will ⅛ of 24 cost?

8. A man raised 280 bushels of oats and sold .35 of it at 31¢ per bushel. How much was received from the sale?

9. How many yards of edging can be bought for $48, at 30¢? 40¢? 33⅓¢? 37½¢? 75¢? 80¢? 66⅔¢?

10. From a piece of cloth containing 36 yards there were sold 5¾ yd., 5⅔ yd., 7⅕ yd., 8$\frac{7}{12}$ yd. How many yards remained?

LESSON 83

1. When two figures are placed side by side, what does the first one at the right denote? What the second? What do the figures 46 denote?

2. What does each figure in 562 denote? In 1234?

3. How much greater is the value of a figure standing in the *second* place than in the *first?* When standing in the *third* place than in the *first?* Than in the *second?*

4. What is the smallest number expressed by *three figures?*

5. Read the following: XL, LX, LXV, LXIV, XC, CX, CCXL, CCLX, DCCC, MC.

6. What part of a bushel is 1 peck 4 quarts?

7. Find the cost of 1 pk. 4 qt. chestnuts if one bushel costs $8.

8. I bought ½ bushel of berries for $1¼, and sold them at the rate of 2 quarts for 25¢. How much was gained?

9. State the relative value of each figure in .444.

10. At 16⅔¢ each, how many dozen lemons can I buy for $2? $4? $5½? 33⅓¢? $1⅛? $2⅔?

11. If .37½ of anything cost 15¢, how much will .75 of it cost?

12. $16⅔ is the sum of .3 and .03⅓ of the cost of my watch. Find the cost.

13. What part of 4 bushels is 2 pecks?

14. What per cent of 4 bushels is 2 pecks?

15. What part of 150 bushels is 30 bushels?

16. What per cent of 150 is 30?

17. If a merchant bought 150 bushels of apples, but found 30 bushels were unsalable, what per cent of the apples were bad? What per cent were good?

LESSON 84

Add the following:

1.	2.	3.
3264.74	7469.03	$96,430.42½
46.84	72.64¾	7369.84
7031.05	764.36	722.76
6003.47	7064.39	5062.46
26.43	704.06¼	70001.64
706.38	536.72	8.56
1549.72½	89.76	58.63
6.33⅛	8031.45	749.38
92.84	732.84	8647.72
729.64	627.62	64321.79
76.36⅔	1847.87½	5682.37⅜

Find the value of :

4. 8.56×50	**9.** $7.84 + 2.5$	**14.** $8.5 + .16\frac{2}{3}$
5. $81 \times .66\frac{2}{3}$	**10.** $48 + .33\frac{1}{3}$	**15.** $\$8.65 + \$.05$
6. $2.8 \times 5\frac{2}{7}$	**11.** $9.6 + 6.6\frac{2}{3}$	**16.** $\$865 + \$.05$
7. $.42 \times 1.4\frac{2}{7}$	**12.** $4\frac{3}{4} \times .6\frac{1}{4}$	**17.** $\$.865 + \$.05$
8. $450 \times 3.3\frac{1}{3}$	**13.** $85 + .16\frac{2}{3}$	**18.** $16\frac{1}{2} \times .16\frac{1}{2}$

Find the total cost :

19. 321 bu. of wheat at $87\frac{1}{2}\cancel{c}$ per bu.

25 gal. 3 qt. of molasses at $56\cancel{c}$ a gal.

820 eggs at $21\cancel{c}$ a dozen.

1 T. 250 lb. of hay at $\$16$ a ton.

62 pr. stockings at $37\frac{1}{2}\cancel{c}$ a pair.

16 lb. 8 oz. steak at $16\cancel{c}$ per pound.

$9\frac{1}{2}$ lb. lard at $13\cancel{c}$ per pound.

20. Find the value of 30 firkins of butter, each contain-ing 56 pounds, at $21\frac{1}{4}\cancel{c}$ per pound.

21. At $6\cancel{c}$ a quart, what will be the cost of 12 gal. 3 qt. 1 pt. of milk ?

LESSON 85

1. How are common fractions expressed ?

2. What does the *denominator* of a fraction show? The *numerator?*

3. What is a *proper fraction?*   Give examples.

4. What is an *improper fraction?*   Give examples.

5. What is a *pure decimal?*   Give examples.

6. What is a *mixed decimal?*   Give examples.

7. What distinction is sometimes made between a decimal fraction and a decimal?

SUGGESTION. — $\frac{5}{10}$ is a decimal fraction, and .5 is a decimal.

8. If 13 yd. of ribbon cost $.91, find the cost of 3½ yd.

9. How many hundredths equal .3?   .4?   .6?   .8?

10. At 5¢ each how many pencils can I buy for .5 of a dollar?   .8 of a dollar?

11. If ⁶⁄₇ of a ton of hay is worth $12, how much is ⅔ of a ton worth?

12. ⅔ of $27 equals ¾ of what a suit of clothes cost. Find the cost of the suit.

13. What is the relation of 27 to 9?   32 to 8?   8 to 32?

14. If 9 men can do a piece of work in 12⅗ days, how long will it take 27 men to do it?

15. $16 is .25 of what sum? $16 is 25% of what sum?

16. 12 is .08 of what number?   12 is 8% of what number?

17. The area of a rectangle is 225 square feet, its length is 25 feet.   What is its width?

18. 21 is .33⅓ of what number? $12 is 33⅓% of the cost of a cow.   Find the cost of the cow.

19. ⅔ of 12 is ⁴⁄₇ of what number?   ⅘ of what number?

20. ¾ of 16 is ⅖ of what number?   40% of what number?

21. I bought tea at $½ a pound, and sold it at $⅝ a pound. How much was gained on 10 pounds?

22. If a boy earns $5¾ in 6 days, how much can he earn in 3 days?   12 days?

23. After spending .4 of my money and .66⅔ of the remainder I had $20 left.   How much had I at first?

24. How much silk can I get for $8 at the rate of 3 yd. for $10?

BILLS

LESSON 86

1. What is a *bill?* Define *debtor.* Define *creditor.*

2. When is a bill receipted?

NOTE. — It is customary for the creditor to render an itemized bill, and if it is not paid, a second form of bill, called a Statement, is sent to the debtor. The *Statement* contains only the words, "To Bill Rendered," or "To Merchandise," together with the amount.

The symbol @, read *at,* indicates the price of *one* of the articles named.

3. In the bill on the following page, name the purchaser. From whom were the goods purchased?

4. Where were the goods purchased? When? When was the bill made out? When was the bill paid?

5. Give the name of the person who receipted the bill for the company.

The following are a few of the abbreviations and symbols commonly used in bills and accounts.

@ . . . . . at.	Dr. . . . debtor.
Acct., %c . . . account.	doz. . . . dozen.
Amt. . . . . amount.	lb.. . . . pound.
bal. . . . . balance.	mdse.. . . merchandise.
bbl. . . . . barrel.	No., # . . number.
¢ . . . . . cents.	payt. . . . payment.
Co. . . . . company.	recd. . . . received.
Cr. . . . . creditor.	yd. . . . yard.

(FORM 1)

6.   NEW YORK, May 19, 1900.

MR. THOMAS WRIGHT,

Bought of W. M. MILLER & Co.

1900						
May	1	16 pr. Suspenders,	@	\$ .33$\frac{1}{3}$	\$ 5	33$\frac{1}{3}$
"	"	26$\frac{3}{4}$ lb. Sugar,	@	.06$\frac{1}{4}$		
"	"	16$\frac{1}{4}$ lb. Raisins,	@	.18		
"	"	12$\frac{1}{4}$ yd. Flannel,	@	.50		
"	"	8 pr. Hose,	@	.37$\frac{1}{2}$		
"	"	10 Hams (110 lb.),	@	.13$\frac{1}{4}$		
		Paid May 26, 1900,			\$	
		W. M. MILLER & Co.				
		Per Luft.				

Complete the above bill.

LESSON 87

1. Make out the following bill according to Form 1, supplying names and date : 16 yd. calico, at 8$\frac{3}{4}$ ¢; 7$\frac{1}{4}$ yd. velvet, at \$1$\frac{3}{4}$; 2$\frac{1}{2}$ doz. handkerchiefs, at \$4$\frac{1}{2}$; $\frac{1}{2}$ doz. pr. kid gloves, at \$1.65 per pair; 8$\frac{1}{2}$ yd. silk, at \$1.75; 36$\frac{1}{2}$ yd. muslin, at 9 ¢; 14$\frac{1}{4}$ yd. cashmere, at \$1.45; 2$\frac{1}{2}$ yd. flannel, at 72 ¢; 12$\frac{1}{2}$ yd. linen, at 87$\frac{1}{2}$ ¢.

2. Make out the following bill according to Form 1, supplying names and date : 5$\frac{1}{2}$ yd. linen edging, at 20 ¢; 30 yd. sheeting, at 17 ¢; 8 pr. woolen stockings, at 62$\frac{1}{2}$ ¢; 16$\frac{1}{2}$ yd. calico, at 8 ¢; 10 yd. gingham, at 12$\frac{1}{2}$ ¢; 3 pr. shoes, at \$2.25; 2 brooms, at 35 ¢.

(Form 2)

3.   PLYMOUTH, PA., May 31, 1900.

MR. ALEXANDER PATTERSON,

To JOHN HANCE.   *Dr.*

1900					$		$	
April	30	To 2 cans Tomatoes,	@ $.12½			25		
"	"	" 8 bars Soap,	@ .06¼			50		
"	"	" 5 bu. Potatoes,	@ .75		3	75	4	50
May	11	" 2 boxes Strawberries,	@ .12½			25		
"	"	" 4¼ lb. Butter,	@ .25		1	12½		
"	"	" 16¼ lb. Sugar,	@ .07		1	15½		
"	"	" 5 boxes Sardines,	@ .28		1	40	3	93
		Recd. payment, June 2, 1900,					$ 8	43
		JOHN HANCE,						
		Per L. Smith.						

4. Make out the following bill according to Form 2, supplying names and date:

June 4, 1901. — 42 yd. muslin, at 6¼ ¢; 8 yd. cashmere, at $1.37½; 9¾ yd. lace, at 35¢.

June 12. — 17½ yd. twilled lining, at 23¢; 25¾ yd. alpaca, at 50¢.

June 19. — 5½ doz. buttons, at 20¢; 16½ yd. bleached muslin, at 7¢.

5. Harrison & Goodall, of Chicago, sold H. H. Perters & Son, June 20, 1901, 65¼ yd. black mohair serge, at 36¢; 27¾ yd. sateen sleeve lining, at 24 ¢; 31½ yd. black Italian cloth, at $1.10; 107¼ yd. black silesia, at 16¢; 93 yd. canvas, at 17¢; 60 yd. red padding, at 87½¢.

Make out the bill and receipt it, using Form 1.

LESSON 88

1. William Smith bought of the American Book Co., New York:

June 18, 1901. —

    300 Guerber's Story of the English, at 65¢;

    500 McMaster's History of the U.S., at $1.00;

    250 Walton & Brumbaugh's Stories of Pa., at 60¢.

July 2, 1901. —

    150 Baldwin's Old Greek Stories, at 45¢;

    300 Easy Steps for Little Feet, at 25¢.

Aug. 1, 1901. —

    260 Natural Elementary Geography, at 60¢;

    300 Natural Advanced Geography, at $1.25.

Make out the bill Aug. 10, 1901, and receipt it, using Form 2, Lesson 87.

2. Wilson Thomas bought of Billings & Son, Philadelphia, Pa., the following:

July 6, 1901. —

    5860 ft. white pine boards, No. 1, at $55 per M.;

    3846 cedar shingles, No. 1, at $5.75 per M.;

    5864 ft. hemlock boards, at $16.50 per M.;

    3600 ft. yellow pine flooring, at $28 per M.

July 30, 1900. —

    563 fence posts (chestnut), at $17 per C.;

    8641 white pine siding, at $40 per M.;

    3864 fence pickets, at 80¢ per C.

Make out a receipted bill July 31, 1901. (Form 2.)

3. July 23, 1901, John Kaiser bought of Kistner & Co. 1 Werner book-case, $29; 1 divan (walnut), $26.50; 1 brass bedstead, $36; ½ doz. dining-room chairs, at

$3.50 ; 25 yd. tapestry Brussels carpet, at 85¢ ; 30 yd. body Brussels, at $1.25 ; 32½ yd. ingrain carpet, at 75¢ ; 35¾ yd. oilcloth, at 60¢.

Make out the bill, supplying all necessary data. (Form 1.)

ACCOUNTS

LESSON 89

An **Account Current** is a detailed record of unsettled business transactions, embracing both debits and credits. It shows the place and date of each transaction, the names of the parties concerned, the items bought and sold, or services rendered, together with quantity, price, etc.

(FORM 1)

1.   BUFFALO, N.Y., July 1, 1901.
WAYNE T. JAMES,

In Account with STEVENS & CO.

1901			Dr.						
May	5	To 25 lb. Butter,		@ $	.23	$5	75		
"	14	" 16 lb. Raisins,		@	.14	2	24		
June	16	" 3 sacks Salt,		@	1.87	5	61	$13	60
			Cr.						
May	7	By 2 tons No. 6 Coal,		@ $2.25		4	50		
June	15	" 3 loads Wood,		@	1.40	4	20	8	70
		Balance due STEVENS & Co.						$ 4	90

2. Arrange, according to the preceding form, the following business transactions of William Hartman, a farmer, in account with John Payne, who keeps a general store in Stewartstown, Pa.:

Jan. 1, 1901. — Payne sold Hartman 15½ lb. granulated sugar, at 9¢; 7 lb. coffee, at 45¢; 3 lb. tea, at 85¢.

Feb. 5. — Hartman delivered Payne 10 bu. potatoes, at 45¢; 8 doz. eggs, at 14¢; 25 lb. dried apples, at 10¢; and bought of him 14 yd. calico, at 8¢; 1 box yeast powder, at 20¢.

March 21. — Hartman bought of Payne 3 gal. kerosene oil, at 20¢; 5 lb. cheese, at 15¢; 1 pr. boots, at $3.25.

LESSON 90

(FORM 2)

1.   ST. LOUIS, June 9, 1901.
JAMES A. WENTS,

In Acct. with FRANCIS WARD.   Dr.   Cr.

1901							
Jan.	30	To 6 gal. Oil,	@ $1.05	$ 6	30		
Feb.	7	" 10 lb. Soda,	@ .09		90		
"	17	By 2 cd. Hickory Wood,	@ 4.50			$9	00
Mar.	9	To 18 bu. Wheat,	@ 1.00	18	00		
April	13	By cash on %,				3	00
"	"	" bal.				13	20
		Recd. payment June 12, 1901.		$25	20	$25	20
		FRANCIS WARD.					

2. Arrange the following transactions according to the preceding form : W. A. Powers, a contractor and builder, in account with Joseph Wilson, a lumber dealer of Johnstown, Pa.

Jan. 9, 1901. — Wilson sold Powers 3865 ft. hemlock scantling, at $13 per M ; 3846 ft. white pine boards, at $45 per M.

Jan. 26, 1901. — Powers repaired barn for Wilson, for which Wilson credited Powers on account $18.50.

Feb. 9, 1901. — Powers delivered Wilson a walnut office table, for which Wilson agreed to pay $14.

March 30, 1901. — Powers bought of Wilson 3864 shingles, No. 1, at $8.75 per M ; 8672 ft. siding, at $32.50 per M ; 3972 ft. N.C. pine, at $25 per M.

April 1, 1901. — Powers paid Wilson $175 on account.

3. Thomas Winder, a carpenter, in account with William Keeler, a bookseller, of Cincinnati, Ohio.

March 1, 1901. — Winder bought of Keeler, 1 Arithmetic, at 60¢ ; 1 Dictionary, at $10 ; 1 Geography, at $1.20 : 1 Lessons in English, at 60¢.

March 7. — Winder put up shelves in Keeler's store, for which Keeler credited him on account $5.

April 16. — Winder paid Keeler $2.25 on account.

May 1. — Winder paid cash to balance account.

Make out the preceding account according to " Form 2," and receipt it.

DENOMINATE NUMBERS

A **Denominate Number** is a concrete number whose unit is a fixed measure of quantity. Thus, 5 pounds is a denominate number, because the *pound* is a unit used to measure quantity of weight. Likewise, 4 feet is a denominate number, the *foot* being used to measure quantity of length.

A quantity expressed in a single unit is called a **Simple Quantity**, or a **Simple Denominate Number**. Thus, 5 pounds, 14 gallons, 9 feet, etc., are examples of simple denominate numbers.

A quantity expressed in several different units is called a **Compound Quantity**, or a **Compound Denominate Number**. Thus, 4 rd. 3 yd. 2ft. 7 in. is an example of a compound quantity, or compound denominate number.

Long Measure is used in measuring lines or estimating distances.

1. How many inches are there in $6\frac{1}{2}$ ft. ? $1\frac{3}{4}$ yd. ? $\frac{5}{6}$ ft. ? .25 ft. ? $.33\frac{1}{3}$ ft. ? 75 % of 1 yd. ?

2. How many feet are there in 2 rd. ? $4\frac{1}{2}$ yd. ?

3. What part of a yard is 1 ft. ? $1\frac{1}{2}$ ft? 2 ft. ? 9 in. ?

4. If a yard of ribbon costs 27 ¢, how much will 2 ft. cost at the same rate ?

5. What part of a mile is 1 rd. ? 20 rd. ? 80 rd. ?

6. What is the relation of a mile to 40 rd. ?

7. How many feet are there in $5\frac{2}{3}$ yd. ? $6\frac{1}{6}$ yd. ?

8. How many rods are there in $.12\frac{1}{2}$ of a mile ?

LESSON 92

1. Change 4 rd. 4 yd. 2 ft. 8 in. to inches.

OPERATION

rd. yd. ft. in.

4   4   2   8

5¼

‾‾‾‾

26 yd.

3

‾‾‾‾

80 ft.

12

‾‾‾‾

968 in. *Ans.*

In 4 rd. there are 4 times 5¼ yd., or 22 yd. Adding the 4 yd., we get 26 yd. In 26 yd. there are 26 times 3 ft., or 78 ft. Adding the 2 ft., we get 80 ft. In 80 ft. there are 80 times 12 in., or 960 in. Adding the 8 in., we get 968 in., the answer.

2. Change 2 mi. 40 rd. 3 yd. to feet.

3. Change 12 rd. 3 yd. 1 ft. 7 in. to inches.

4. Change 1856 in. to rods, yards, etc.

Dividing 1856 by 12 to change to feet, we get 154 ft. and 8 in. over. Dividing 154 by 3 to change to yards, we get 51 yd. and 1 ft. over. Dividing 51 by 5½ to change to rods, we get 9 rd. and 1½ yd. over.

OPERATION

12 | 1856 in.

3 | 154 ft. 8 in.

5½ | 51 yd. 1 ft.

9 rd. 1½ yd.

Ans. = 9 rd. 1½ yd. 1 ft. 8 in.

5. How many rods, yards, etc., in 4260 ft.?

6. Change to higher denominations 4365 yd., 7264 ft.

7. Change 9 mi. 84 rd. 2½ yd. to feet.

LESSON 93

1. Add 4 mi. 29 rd. 3 yd. 1 ft. 7 in.; 6 mi. 78 rd. 5 yd. 2 ft. 11 in.; 7 mi. 36 rd. 4 yd. 1 ft. 8 in.

Adding the column of inches, we get 26 in., which equal 2 ft. 2 in. Writing the 2 in. under the column of inches, and carrying the 2 ft. to the column of feet, and adding we get 6 ft., which equal 2 yd. Carrying the 2 yd. to the column of yards and adding, we get 14 yd., which equal 2 rd. 3 yd. Writing the 3 yd. under yards,

OPERATION

mi.   rd. yd. ft.   in.

4   29   3   1   7

6   78   5   2   11

7   36   4   1   8

‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾

17   145   3   0   2 *Ans.*

and carrying the 2 rd. to the column of rods and adding, we get 145 rd. Adding the column of miles, we get 17 mi.

2. Add 12 rd. 4 yd. 2 ft. 8 in.; 16 rd. 2 yd. 1 ft. 10 in.; 19 rd. 5 yd. 11 in.; 9 rd. 3 yd. 2 ft. 9 in.

3. Add 8 mi. 42 rd. 3 yd. 2 ft. 9 in.; 7 mi. 14 rd. 13 ft. 8 in.; 16 mi. 14 rd. 7 in.; 32 rd. 2 yd. 9 in.

4. From 21 mi. 125 rd. 5 yd. 1 ft. 9 in. take 10 mi. 136 rd. 2 yd. 2 ft. 7 in.

7 in. from 9 in. = 2 in., which we write under the column of inches. Since 2 ft. cannot be taken from 1 ft., we take 1 yd. (1 yd. = 3 ft.) and add it to the 1 ft., thus making 4 ft. 2 ft. from 4 ft. = 2 ft., which we write under the column of feet. 2 yd. from 4 yd. = 2 yd., which we write under the column of yards. Since 136 rd. cannot be taken from 125 rd., we take 1 mi. (1 mi. = 320 rd.) and add it to the 125 rd., thus making 445 rd. 136 rd. from 445 rd. = 309 rd., which we write under the column of rods. 10 mi. from 20 mi. = 10 mi.

OPERATION				
mi.	rd.	yd.	ft.	in.
21	125	5	1	9
10	136	2	2	7
10	309	2	2	2 *Ans.*

LESSON 94

Subtract:

1.			**2.**				**3.**			
rd.	ft.	in.	rd.	yd.	ft.	in.	mi.	rd.	yd.	in.
28	9	6	84	2	1	6	49	38	4	9
12	14	4	21	4	2	8	18	147	5	11

4. Subtract 32 mi. 310 rd. 3 yd. 2 ft. 9 in. from 84 mi. 5 yd.

5. Subtract 39 mi. 12 ft. 6 in. from 126 mi. 1 rd. 1 yd. 1 ft.

6. Multiply 3 mi. 59 rd. 3 yd. 5 ft. 8 in. by 7.

7 times 8 in. = 56 in. = 4 ft. 8 in. We write the 8 in. under the inches, and add the 4 ft. to the product of feet. 7 times 5 ft., plus 4 ft. (7 × 5 ft.) + 4 ft. = 39 ft. = 13 yd. We write a cipher under feet, and add the

OPERATION				
mi.	rd.	yd.	ft.	in.
3	59	3	5	8
				7
22	99	1	0	8 *Ans.*

13 yd. to the product of yards. 7 times 3 yd., plus 13 yd. (7 × 3 yd.) + 13 yd. = 34 yd. = 6 rd. 1 yd. We write the 1 yd. under yards, and add the 6 rd. to the product of rods. 7 times 59 rd., plus 6 rd. (7 × 59 rd.) + 6 rd. = 419 rd. = 1 mi. 99 rd. We write the 99 rd. under rods, and add the 1 mi. to the product of miles. 7 times 3 mi., plus 1 mi. (7 × 3 mi.) + 1 mi. = 22 mi., which we write under miles.

Multiply :

7.					**8.**				**9.**		
mi.	rd.	ft.	in.		mi.	rd.	yd.		mi.	rd.	yd.	ft.
18	16	10	3		25	36	7		18	120	2	9
			7				8					6

10. Multiply 60 mi. 240 rd. 9 ft. by 9.

11. Multiply 120 mi. 4 yd. 2 ft. 7 in. by 7.

12. Multiply 17 mi. 42 rd. 13 ft. 8 in. by 8.

LESSON 95

1. Divide 129 mi. 50 rd. 7 ft. by 8.

⅛ of 129 mi. = 16 mi., and 1 mi. remaining. We write the 16 mi. in the quotient under miles, and change the 1 mi. to its equivalent, 320 rd., which we add to the 50 rd., thus making 370 rd. ⅛ of 370 rd. = 46 rd., and 2 rd. remaining. We write the 46 rd. under rods, and change the 2 rd. to its equivalent, 33 ft., which added to 7 ft. make 40 ft. ⅛ of 40 ft. = 5 ft., which we write in the quotient under feet.

OPERATION

	mi.	rd.	ft.	
8)	129	50	7	
	16	46	5	*Ans.*

Divide :

	2.					**3.**					**4.**		
	rd.	yd.	ft.			yd.	ft.	in.			rd.	ft.	in.
9)	69	4	6		11)	303	0	11		12)	54	14	9

	5.					**6.**					**7.**		
	mi.	rd.	ft.	in.		mi.	rd.	yd.	ft.		rd.	yd.	ft.	in.
7)	49	160	9	4		6)	95	0	1	8		8)	191	4	2	10

8. Change 2 yd. 2 ft. 3 in. to inches.

9. Multiply 3 mi. 90 rd. 2 yd. 4 ft. 7 in. by 6.

10. Find $\frac{1}{4}$ of 21 rd. 3 yd. 4 ft. 8 in.

11. Find .25 of 17 rd. 4 yd. 7 ft. 10 in.

12. Find 25% of 5 mi. 310 rd. 5 yd. 2 ft.

13. How many steps, each 2 ft. 8 in. long, will a man take in walking 5 miles?

14. How much will $36\frac{1}{2}$ ft. of wire fencing cost at $1.20 per rod?

15. If 18 seconds intervene between the flash and report of a gun, what is its distance, the velocity of sound being 1090 ft. per second? Answer in miles, rods, and feet.

16. If a horse can trot 280 rd. in 3 minutes, how far, at the same rate, would he travel in 10 minutes?

LESSON 96

1. For what is **Surveyors' Linear Measure** used?

2. Recite the table of surveyors' linear measure.

3. How many links are there in 2 ch.? In 4 rd.?

4. How many inches are there in a chain?

5. 50 li. equal how many rods? How many feet are there in 50 li.?

Gunter's chain, named after its inventor, Edmund Gunter, is 792 in. long, or 66 ft., or 4 rd. Surveyors generally use a chain or tape 100 ft. long.

6. For what is **Surface** or **Square Measure** used?

7. Recite the table of surface or square measure.

8. How many square feet are there in 4 sq. yd.?

9. 36 sq. ft. equal how many square yards?

10. 12 sq. in. equal what part of a square foot?

11. 36 sq. in. equal what part of a square foot?

12. 36 sq. in. equal what per cent of a square foot?

13. How many square rods are there in $2\frac{1}{2}$ A.?

14. 25% of an acre equals how many square rods?

15. How many square inches are there in $12\frac{1}{2}$% of a square foot?

16. How many square rods are there in 75% of an acre?

17. How many square feet are there in $33\frac{1}{3}$% of 2 sq. yd.?

18. $12\frac{1}{2}$ mi. equal how many chains?   40 ch. equal how many rods?

19. How many links and inches are there in 240 in.?

20. How many chains and links are there in 760 li.?

21. A piece of land is 5 ch. 50 li. long. How many feet long is it?

22. Change 9 sq. yd. 4 sq. ft. 27 sq. in. to square inches.

23. Change 4 A. 20 sq. rd. 25 sq. yd. to square feet.

24. Change 129600 sq. in. to square yards.

25. Change to square rods: $15\frac{1}{5}$ sq. yd., 121 sq. yd., $2\frac{1}{2}$% of 1 acre.

LESSON 97

A **Solid** or **Volume** is that which has the dimensions *length, breadth,* and *thickness* or *height.*
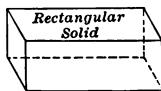
A **Rectangular Solid** is one that is bounded by six rectangles.

A **Cube** is a solid that is bounded by six equal squares.

1. For what is **Cubic, or Solid Measure** used ?

2. Recite the table of cubic, or solid, measure.

3. How many cubic yards are there in 81 cubic feet?

4. How many cubic feet are there in $\frac{1}{4}$ of a cubic yard ?

5. How many cubic feet are there in $\frac{1}{3}$ of a perch ?

6. $33\frac{1}{3}\%$ of a cubic yard equals how many cubic feet?

7. Change 16 cu. yd. 13 cu. ft. 24 cu. in. to cubic inches.

8. Change 1760 cu. yd. to cubic feet.

9. How many cubic yards are there in 288 cu. ft. ?

A *Cord of Wood* is usually represented by a pile 8 ft. long, 4 ft. wide, and 4 ft. high. It, therefore, contains $8 \times 4 \times 4$, or 128 cu. ft. See p. 138.

A *Perch of Stone* or masonry is $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. wide, and 1 ft. high, and contains $16\frac{1}{2} \times \frac{1}{2} \times 1$, or $24\frac{3}{4}$ cu. ft.

10. Change 151 cu. yd. 19 cu. ft. to cords.

11. Divide 193 cu. yd. 26 cu. ft. 329 cu. in. by 8.

12. Add 8 cu. yd. 1240 cu. in., 23 cu. yd. $16\frac{1}{2}$ cu. ft.

13. Subtract 74 A. 131 sq. rd. 10 sq. yd. 8 sq. ft. 120 sq. in. from 95 A. 116 sq. rd. 25 sq. yd. 2 sq. ft. 15 sq. in.

14. Multiply 4 cords 18 cu. ft. 844 cu. in. by 7.

LESSON 98

1. For what is **Liquid Measure** used ?
The standard unit is the *gallon*. It contains 231 cu. in.

2. Recite the table of liquid measure.

3. What part of a gallon is a pint?   5 pints?

4. If 5 pints of vinegar are worth 15¢, how much are 2½ gal. worth?

5. What part of 2 gallons are 4 pt.?   8 pt.?   12 pt.?

6. Find the cost of 3.2 pints of sirup at 40¢ a gal.

7. If 2½ pints are taken from 2½ gallons, how many pints are left?

8. How many gallons are there in ⅚ of a hogshead?

9. Change to gills: ⅘ qt., ⅔ qt., 1½ qt., 2¾ qt., 2.5 qt.

10. Change to gallons: 21 qt., 90 pt., 27 qt., 48 gills, 72 gills.

11. At 9¢ a pint, find the cost of ⅔ of a gallon of sweet cream.

12. For what is **Dry Measure** used?

The standard unit of dry measure is the *bushel*.   It contains 2150.42 cubic inches.

Grains, seeds, and small fruits are sold by stricken measure.   Coarse vegetables, large fruits, and bulky articles, such as potatoes, turnips, apples, lime, etc., are sold by heaped measure.

13. Change to quarts: 4 pk. 2 qt.; 1 bu. 2 pk. 1 qt.; ⅔ bu.

14. 15 qt. equal ¾ of how many pecks?   ⅚?   ⅜?

15. What is the cost of 2¾ pk. of beans at $1.60 a bushel?

16. What part of 2 pk. is ½ pk.?   12½% of 1 bu. equal how many quarts?

17. 33⅓% of 96 pt. equal how many pecks?

18. How many pint bottles will be required to hold 2⅜ gallons?

19. What part of a bushel is 1 pt.?   .1 of a pint?

LESSON 99

1. Change 10 bu. 3 pk. 5 qt. 1 pt. to pints.

2. Add 9 gal. 3 qt., 18 gal. 2 qt. 1 pt., 10 gal. 1 qt., 21 gal. 2 qt.

3. From 26 gal. 2 qt. take 18 gal. 3 qt. 1 pt.

4. Divide 37 bu. 1 pk. 2 qt. 1 pt. by 9.

5. A man feeds each of his 4 horses 10 qt. of oats daily. How long will 456 bu. 1 pk. last them?

6. I bought 3 bu. 2 qt. of berries at 48¢ a bushel. How much did I pay for them?

7. A merchant bought 150 gal. of sirup at 20¢ a gallon, and sold it at 6¢ a quart. Find the gain.

8. Change to gallons: 3200 gills; 3565 gills.

9. Find the cost of 25 gal. 3 qt. linseed oil at 20¢ a quart.

10. A merchant bought 5 bbl. of coal oil, each containing 40 gal., at $1\frac{1}{2}$¢ a pint. How much did he pay for it?

11. For what is **Avoirdupois Weight** used?

12. Recite the table of avoirdupois weight.
There are 7000 grains in an avoirdupois pound.

13. How many ounces are there in 5.5 lb.? In 5.75 lb.?

14. $37\frac{1}{2}\%$ of 1 lb. equals how many ounces?

15. 2 ounces equal what part of a pound? What per cent of a pound?

16. Change to pounds: 75 oz., 80 oz., 24 oz., 98 oz., 12 oz.

17. What per cent of a ton is a hundredweight? 3 cwt.? 300 lb.?

18. How many pounds are there in $\frac{4}{5}$ of a ton ? $\frac{3}{8}$ of 3.5 tons ?

19. 50% and 75% of an acre equal how many sq. rd. ?

20. A boy gathered 16$\frac{1}{2}$ qt. of huckleberries, and sold $\frac{1}{2}$ of them at 10$\not$ a quart, and the remainder at 8$\not$ a quart.   How much did he receive for them ?

LESSON 100

1. For what is **Troy Weight** used ?

2. Recite the table of Troy weight.

There are 5760 grains in a Troy pound.

3. How many grains are there in 2$\frac{1}{2}$ pwt. ?   In 1 oz. ?

4. How many pennyweights are there in 75 gr. ?   In 5$\frac{1}{2}$ oz. ?

5. How many grains are there in 87$\frac{1}{2}$% of an ounce ?

6. What part of a pound Troy weight is 2 oz. ?   What per cent ?

7. Which is the heavier, a pound of iron or a pound of gold ?   Why ?

8. How many ounces in 18 cwt. 46 lb. 9 oz. ?

9. How many pounds in 18 T. 39 cwt. 75 lb. ?

10. Change 8964 oz. to higher denominations, avoirdupois weight.

11. Reduce 8 oz. 17 pwt. 14 gr. to grains.

12. How many ounces, pennyweights, and grains in 84,793 gr. ?

13. If 4 silver water pitchers weigh 29 lb. 5 oz. 7 pwt. 8 gr., find their average weight.

14. When 18 pwt. of silver are worth $1.26, what is the value of 3 lb. 9 oz. 17 pwt. 8 gr. of silver?

15. How many cubic inches in a quart, dry measure?

16. How many cubic inches in a quart, liquid measure?

17. Which is the heavier, a pound of silver or a pound of butter? An ounce of silver or an ounce of butter?

18. From 35 lb. 1 pwt. take 33 lb. 5 oz. 9 pwt. 7 gr.

19. Change 184896 oz. to tons.

20. Find the cost of $28\frac{1}{2}$ cwt. of hay at $16 a ton.

LESSON 101

1. For what is **Apothecaries' Weight** used?

2. Recite the table of apothecaries' weight.

3. How many grains are there in $4\frac{1}{2}$ ʒ ?

4. How many ounces are there in 24 ʒ ? In 55 ʒ ?

5. How many ℈ are there in 95 gr. ?

6. How many ʒ are there in $3.12\frac{1}{2}$ ℥ ?

7. If a family use 6 pints of water a day, how long will a $7\frac{1}{2}$ gallon can last them?

8. What are the denominations in **Time Measure**?

9. Name the months and the number of days in each.

Years divisible by 4, except centennial years, are *leap years;* and centennial years divisible by 400 are also *leap years.*

10. Which are leap years? 1884? 1889? 1890? 1892? 1900? 1960? 1872? 2000?

11. Find the sum of 7 ℥ 6 ʒ 1 ℈ 15 gr., 4 lb. 8 ℥ 6 ʒ 2 ℈ 16 gr., 4 lb. 7 ℥ 4 ʒ 16 gr.

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12. Divide 38 wk. 5 da. 18 hr. 21 min. 46 sec. by 7.

13. A note dated April 10, 1894, was paid Jan. 3, 1900. Find the time the note was on interest.

OPERATION

When the period is long the method of compound subtraction is generally employed to find the time. 30 days are considered a month.

	yr.	mo.	da.
	1900	1	3
	1894	4	10
	5	8	23

14. General Robert E. Lee was born Jan. 19, 1807. What was his age when the battle of Gettysburg was fought, July 1, 1863?

15. Benjamin Franklin was born Jan. 17, 1706, and died April 17, 1790. Find his age.

16. Find the number of days from June 8, 1899, to Jan. 5, 1900.

SUGGESTION. — There are 22 days remaining in June; in July there are 31; in Aug. 31; Sept. 30; Oct. 31; Nov. 30; Dec. 31; and in Jan. 5.

17. Find the number of days from Oct. 30, 1899, to April 20, 1900.

LESSON 102

1. A miner worked full time in May, the first day of May being Friday, and half time in June. How many days did he work in both months?

2. A note dated June 8, 1899, was paid 9 mo. 3 da. after date. Find the date of payment.

3. Find the rent of a house for 1 yr. 7 mo. at $15 a month.

4. Change 11 oz. 7 pwt. 23 gr. to grains.

5. How many grains are there in 1 oz. Av.? Troy?

6. How much will 3650 lb. coal cost at $3 a ton?

7. How much are 30 gross of buttons worth at 4 ¢ a dozen ?

8. A dealer sold 2 bundles of paper at ½ ¢ a sheet. How much did he receive for it ?

9. A druggist sold 8 ℥ of quinine at the rate of 30 gr. for 10 ¢. How much did he receive for it ?

10. 37½ % of a hundredweight equals how many ounces ?

11. Multiply 2 wk. 3 da. 7 hr. 35 min. 40 sec. by 5.

12. If 3 pk. of onions cost $ ⅔, how much will 2¾ bu. cost ?

13. Change to seconds and add : ¾ min., 1⅜ min., ⅚ min., 2⅜ min., 3.3 min., 4.33⅓ min.

14. A merchant bought 10 gross of buttons at $1.50 a gross, and retailed them at 15 ¢ a dozen. How much did he gain ?

15. How many ounces are there in 18 cwt. 46 lb. 9 oz.?

16. Change 8964 oz. to higher terms, avoirdupois weight.

17. How much will 66⅔ % of a ream of paper cost at ¾ ¢ a sheet ?

18. How many pounds are there in 25 % of ¾ of a ton ?

19. Three loads of coal weighed 4 T. 3 cwt. 65 lb. The first weighed 1 T. 4 cwt. 85 lb. The second weighed 1 T. 9 cwt. 90 lb. How much did the third load weigh ?

LESSON 103

1. Change to quarts and add : ⅔ pk., ⅜ pk., 2⅔ pk., ¾ pk., 3.37½ pk.

2. Find the value of 1635 lb. of wheat at 96 ¢ a bushel, allowing 60 lb. to the bushel.

3. If 3 gal. 2 qt. 1 pt. of cider are taken from a keg of cider containing 5 gal., how much is left in the keg ?

4. How many bushels and pecks are there in 2895 lb. of beans, allowing 60 lb. to the bushel?

5. How far will a train travel in $4\frac{2}{3}$ hr. at the rate of 15 mi. in 45 min.?

6. If a clock gains 2 min. 18 sec. each day, how much will it gain in a week?

7. How much will .62$\frac{1}{2}$ of 2 reams of paper cost at $.005 a sheet?

8. How many days are there in 38,694 hr.?

9. Change 6 bales 2 bundles 11 quires 16 sheets to sheets.

10. When 18 pwt. of silver are worth $1.26, what is the value of 9 oz. 17 pwt.?

11. A man was born Feb. 7, 1849, and died May 16, 1899. How old was he when he died?

12. Change to feet and add: $\frac{2}{4}$ yd., $1\frac{2}{3}$ yd., $\frac{7}{12}$ yd., $\frac{5}{9}$ yd., $\frac{7}{8}$ yd.

13. How many ounces, pennyweights, and grains in 64,723 gr.?

14. Find the number of days from May 30, 1900, to July 4.

15. Change to feet and add: $\frac{2}{3}$ rd., $\frac{3}{4}$ rd., $\frac{3}{8}$ rd., 1.5 rd., .62$\frac{1}{2}$ rd.

16. Find the cost of 18 cwt. 36 lb. of beef, at $11\frac{1}{4}$¢ per lb.

17. Change to hours and add: $\frac{2}{3}$ da., .7 da., $\frac{4}{9}$ da., 3.4 da., .87$\frac{1}{2}$ da.

18. Puckey Bros. bought 25 gross of Spencerian pens for $18, and retailed them 3 pens for 5¢. How much did they gain?

LESSON 104

English Money, sometimes called sterling money, is the legal currency of Great Britain. The unit is the *pound sterling*, and it is worth about $4.86. There is no coin known as the pound sterling. It is represented by a gold coin called a *sovereign*.

1. Recite the table of English money.
2. Recite the table of United States money.
3. How many dollars equal 2.5 eagles?
4. .75 of an eagle equals how many dollars?
5. How many shillings are there in £3 7s.?
6. How many pence are there in £.5? In £.75?
7. 25% of a half eagle equals how many dollars?
8. 120 pence equals what part of a pound?
9. 60 pence equals what per cent of a pound?
10. What part of a pound is $2\frac{1}{2}$ shillings?
11. Name the gold coins of U.S. money, the silver coins, the nickel, the bronze.
12. $12 is what per cent of $100? $12 is what per cent of $24?
13. Change to farthings: £3 12s. 4d., £8 7s. 3¾d., £18 14s. 7¼d., £9 16s. 6.5d.
14. Change to higher denominations: 43,657 far., 42,586d., 36,497 far., 37,945d.
15. How much of U.S. money is a shilling worth? 3 shillings?
16. How much of U.S. currency is a penny worth?
17. What is the value of £3 10s. in U.S. money?
18. How much is a dozen worth when 50¢ is paid for a score?

PRACTICAL MENSURATION

LINES AND ANGLES

LESSON 105

A **Line** is that which has length only.

A **Straight Line** is one that does not change its direction.

_____

A **Curved Line** is one that continually changes its direction.

Parallel Lines are those that have the same direction.

The difference in direction between two straight lines that meet in a common point is called an **Angle**.

When one straight line meets another straight line so as to form two equal angles, the lines are said to be **Perpendicular** to each other, and the angles thus formed are called **Right Angles**.

When an angle is less than a right angle it is called an **Acute Angle**.

When an angle is greater than a right angle it is called an **Obtuse Angle**.

1. Draw two straight lines so as to form *one* angle; *two* angles; *four* angles.

2. Draw two straight lines so as to form an *acute* angle; a *right* angle; an *obtuse* angle.

3. Draw two straight lines so as to form one right angle; two right angles; four right angles; one obtuse and one acute angle; two obtuse and two acute angles.

4. Will the size of an angle be increased by lengthening its sides?

5. If two straight lines are drawn from a point, one due east and the other due north, what kind of an angle do they form?

6. If two straight lines are drawn from a point, one due east and the other northwest, what kind of an angle do they form?

SURFACES AND PLANE FIGURES

LESSON 106

A **Surface** is that which has the dimensions length and breadth.

A **Plane Surface** is a level surface. When no part of a surface is plane, it is called a **Curved Surface.**

1. What kind of surface is the floor of your schoolroom? The ceiling? The walls? The blackboard?

2. What kind of surface is that of a ball? Of a slate pencil?

3. Name three objects having a surface like that of a ball. Three having a surface like a slate pencil. Three having a surface like the top of a table.

A **Plane Figure** is a plane surface bounded by straight or curved lines.

A **Polygon** is a plane surface bounded by three or more straight lines.

The **Perimeter** of a polygon is the distance around it. A polygon of three sides is called a **Triangle**.
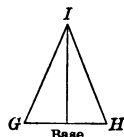
TRIANGLES
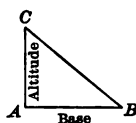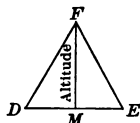
FIG. 1   FIG. 2   FIG. 3   FIG. 4

The **Base** of a triangle is the side upon which it seems to stand, as *AB* (Fig. 1).

The **Vertex** is the point opposite the base, as *F* (Fig. 2).

The **Altitude** is the perpendicular distance from the vertex to the base, as *FM* (Fig. 2).

LESSON 107

Considered with reference to the relative size of their angles, triangles are distinguished as right-angled, acute-angled, or obtuse-angled.

A **Right-angled Triangle**, or right triangle, has one right angle (Fig. 1).

An **Acute-angled Triangle** has three acute angles (Fig. 2).

An **Obtuse-angled Triangle** has one obtuse angle (Fig. 4).

Considered with reference to the relative length of their sides, triangles are distinguished as equilateral, isosceles, or scalene.

An **Equilateral Triangle** has three equal sides (Fig. 2).

An **Isosceles Triangle** has two equal sides (Fig. 3).

A **Scalene Triangle** has three unequal sides (Fig. 4).

A polygon of four sides is called a **Quadrilateral.**

QUADRILATERALS

Rectangle   Square   Rhomboid

.Rhombus   Trapezoid   Trapezium
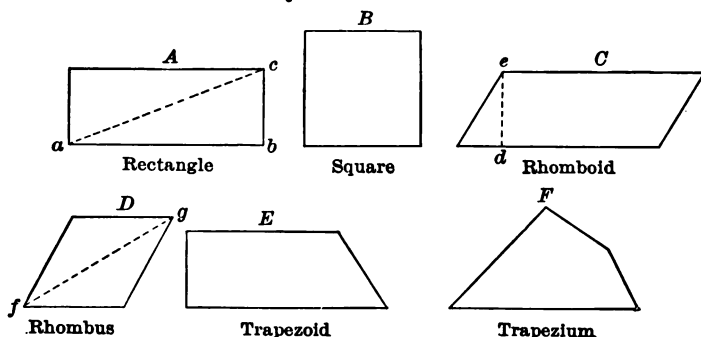
The first four of the figures above are called **Parallelograms,** because their opposite sides are parallel.

The **Base** of a parallelogram is the side upon which it seems to stand, as *ab*, Fig. *A.*

The **Altitude** of a parallelogram is the perpendicular distance between the base and the side opposite, as *de*, Fig. *C.*

The **Diagonal** of a quadrilateral is a straight line joining its opposite angles, as *ac*, Fig. *A*, and *fg*, Fig. *D.*

LESSON 108

A **Rectangle** is a plane surface having four right angles, as Fig. *A*, above.

A **Square** is a rectangle whose four sides are of equal length, as Fig. *B*, above.

A **Rhomboid** is an oblique-angled parallelogram, as Fig. *C.*

A **Rhombus** is a rhomboid whose four sides are of equal length, as Fig. *D.*

A **Trapezoid** is a quadrilateral having only two of its sides parallel, as Fig. *E*, p. 121.

A **Trapezium** is a quadrilateral having none of its sides parallel, as Fig. *F*, p. 121.

1. Why are the pages of this book quadrilaterals? Why parallelograms?

2. Point out any parallelograms in your schoolroom, and tell why they are parallelograms.

3. In what particular respect are a rectangle and a square alike? Wherein are they unlike?

4. If you cut a rectangle of paper through the diagonal into two parts, what plane figure is each part, and what part of the rectangle is each part?

5. Compare the base of each triangle with the length of the rectangle.

6. Compare the rectangle with the rhomboid, and state wherein they are unlike.

7. If you cut a square into two equal triangles, what kind of triangle is each?

8. In what respect are a trapezoid and a rhomboid unlike?

9. Wherein does a rhombus resemble a square?

AREAS

LESSON 109

A square, each side of which is an inch long, is a **Square Inch.**

1. What is a square foot? A square yard? A square rod?

2. What is the perimeter of a square inch? A square foot? A square mile?
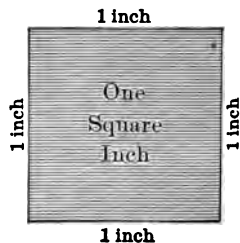
3. What is a two-mile square ? What are two square miles ?

4. In what particular respect are a square yard, a square rod, and a square mile alike ? In what respect are they different ?

The area of a polygon is the number of square units of surface of a certain value it contains. The square inch, the square foot, the square yard, the square rod, the square chain, the acre, and the square mile are the principal English surface measure units used in computing areas.

Area of a Rectangle. The area of a rectangle is the product of its base and altitude.

1. Draw a rectangle 6 in. long and 3 in. wide. Divide the edges into parts 1 in. long, and draw lines connecting the opposite points of division, as shown in the diagram.
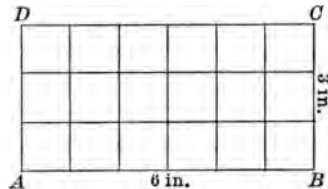
2. What is the shape of the parts into which you have divided the rectangle ?

3. How many of these parts have you ? Count them, writing inside of each square its number from one upwards.

4. How many rows have you with six in each row?

5. How many rows have you with three in each row ?

6. What is the area of your rectangle?

7. Can you make a rule for finding the area of a rectangle ?

8. Will your rule apply to a square as well ?

LESSON 110

1. What is the area of a field 48 rd. long and 36 rd. wide?

**2.** What is the value of a square field 80 rd. long, at $37½ an acre?

3. A piece of land is 70 yd. long and 60 yd. wide, and has the shape of a rectangle. Draw a plan of the field on the scale of 20 yd. to the inch, that is, let 1 inch represent 20 yd. on your plan. What is the area of your plan? What is the area of the field?

**4.** Given the area and one side of a rectangle, how do you find the other side?

5. What is the length of a field whose width is 60 rd. and whose area is 5400 sq. rd?

Area of a Rhomboid. The area of a rhomboid is equal to the product of its base and altitude.

6. Draw on paper a rhomboid $ABCD$ with its two opposite sides 3 inches long, and 2 inches apart. Consider AB the base, and draw the altitude DE.
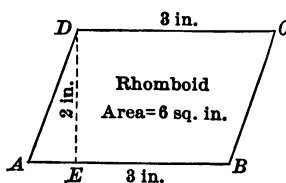
7. Cut the rhomboid out from the paper. Cut off the triangle ADE and place it at the right of the figure in the position BCE'. You see you have changed the rhomboid into a rectangle retaining the same base and altitude.
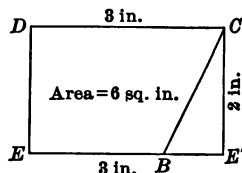
As the area of a rectangle is equal to the product of its base and altitude, this is also the area of the rhomboid.

LESSON 111

1. What is the area of a rhomboid whose length is 72 rd. and width 48 rd. ?

2. A piece of land is 800 rd. long and 60 rd. wide, and has the shape of a rhomboid. What is its value at $50 an acre?

3. A room 15 ft. long requires 20 sq. yd. of carpet to cover the floor. How wide is the room?

4. What is the area of a rhomboid whose length is 9 chains and width 5 chains? Express the area: 1st, in square chains; 2d, in square feet; 3d, in square rods; 4th, in acres.

5. The area of a room 36 ft. long is 120 sq. yd. What is the width of the room?

Area of a Rhombus. As a rhombus is a rhomboid whose four sides are of equal length, the area of a rhombus is equal to the product of the base and altitude.
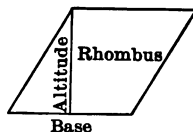
6. How many square rods are there in a field in the form of a rhombus, each side measuring 64 rods, and the perpendicular between opposite sides 50 rods? How many acres?

7. The base of a rhombus is 30 yd. and altitude 70 ft. Find its area.

8. The base of a rhomboid is 30 ch. and the altitude 25 rods. What is its area?

9. What is the area of the walls of a room 30 ft. long, 24½ ft. wide, and 14 ft. high? What is the area of the ceiling?

10. Find the cost of plastering the walls and ceiling of the room described in Ex. 9, at 20¢ a square yard.

LESSON 112

Area of a Triangle. The area of a triangle is equal to one half of the product of its base and altitude.

The **Base** is any one of its sides.

The **Altitude** is the perpendicular distance from the base to the vertex of the opposite angle. Thus, in the triangle *ABC*, the base is *AB*, and the altitude *CD*.
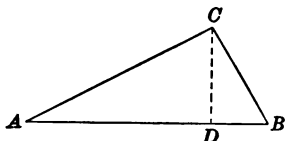
1. Draw on paper a parallelogram *ABCD* of any convenient size as shown in the diagram.

Taking *AB* for the base, draw the altitude *DE*, and the diagonal *DB*. Cut out the parallelogram from the paper, and cut it into two parts along the diagonal *DB*. Now turn one part around and place it directly on top of the other, and you will see that the two triangles are equal. There are several kinds of triangles; but all can be formed by cutting quadrilaterals into two parts from corner to corner.
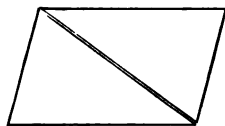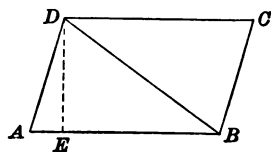
As the area of a parallelogram is equal to the product of its base and altitude, so the area of a triangle, which is one half the parallelogram, is one half the product of the base and altitude of the parallelogram, that is, one half the product of its own base and altitude.

2. What is the area of a triangle whose base is 24 ft. and altitude 14 ft.?

3. The base of a triangle is 20 rd. and the altitude is 12 rd. What is the area of the triangle?

4. Find the area of a triangle whose base is 24 yd. and altitude 2 rd.

5. How many acres are there in a triangular piece of land having a base of 80 rd. and an altitude of 56 rd.?

LESSON 113

Draw the following triangles on a scale of $\frac{1}{2}$ in. to the foot, and calculate their areas. Write the area and the value of the given parts in and about the diagrams:

Area=9 sq.ft.

Base=6 ft.

Scale $\frac{1}{2}$ in. to foot

MODEL
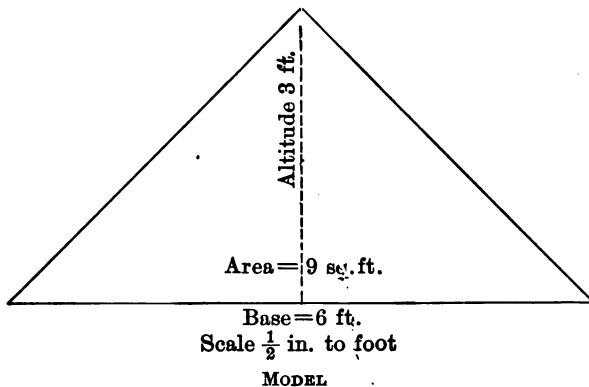
1. Base 6 ft. and altitude 3 ft.

2. Base 4 ft. and altitude 2 ft.

3. Base 8 ft. and altitude 4 ft.

4. Base 5 ft. and altitude 3 ft.

5. A right triangle, the sides of the right angle being 5 ft. and 4 ft.

**6.** A right isosceles triangle whose equal sides are 5 feet.

Area of a Trapezoid. The area of a trapezoid is equal to its altitude multiplied by one half of the sum of the parallel sides.

The figure $ABCD$ is a trape-
zoid. The parallel sides are AB
and CD. The length of a trape-
zoid is represented by a line
parallel to and midway between
the parallel sides, as EF.
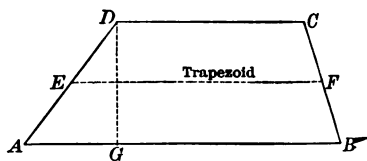
7. Draw on paper a trapezoid $ABCD$ of any convenient
size, in which AB and CD are the parallel sides.

Draw EF connecting the
middle points of AD and
BC. Measure off on AB
the distance AH equal to
EF.
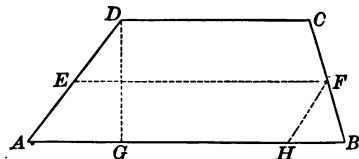
Draw HF. Cut out the
trapezoid from the paper, and cut off the triangle HBF,
and place it in the position $H' CF$.

You have now changed
the trapezoid into a
parallelogram. The two
parallel sides of the trape-
zoid have been made the
equal sides of the paral-
lelogram, and one half the sum of the parallel sides is
equal to AH, which is the base of the parallelogram.
The altitude DG remains unchanged.
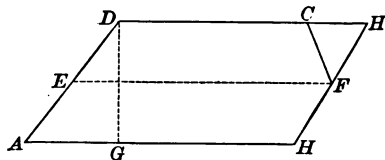
As the area of a parallelogram is the product of its alti-
tude and base, so the area of a trapezoid is the product of
its altitude and one half the sum of its bases.

LESSON 114

1. Find the area of a trapezoid whose parallel sides are
70 ft. and 150 ft., and altitude 40 ft.

2. I have a flower bed in the shape of a trapezoid. The two parallel sides are 12 ft. and 14 ft., and the perpendicular distance between the parallel sides is 10 ft. Find the area.

3. The sum of the parallel sides of a trapezoid is 150 yards, and the perpendicular 75 yards. How many square yards are there in the area?

4. One parallel side of a field in the shape of a trapezoid is 150 rd., the other 200 rd. How many square rods are there in the field, the perpendicular distance between the sides being 50 rd.? How many acres?

Make a diagram on a scale of 50 rd. to an inch.

5. Find the cost of cementing a cellar bottom 54 ft. long and $18\frac{1}{2}$ ft. wide, at $62\frac{1}{2}$¢ a square yard.

Since the area of a parallelogram is equal to the product of its length and breadth, either side will equal the area divided by the other side.

6. A blackboard has a surface of 105 sq. ft. What is the width of the board if it is 30 ft. long?

7. What is the length of a trapezoid whose parallel sides are respectively 24 ft. and 32 ft.?

8. How many feet are there in the perimeter of an equilateral triangle, each side of which is $5\frac{1}{2}$ yards long?

9. How many strips of carpet, $\frac{3}{4}$ yd. wide, will be needed for a room 18 ft. wide?

10. If the above room is 22 ft. long, how many yards of carpet will be needed to cover the floor?

LESSON 115

1. If the base of a triangle is 12 yards and the altitude 8 yards, what is the area of the triangle?

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2. Draw a diagram of a right-angled triangle whose base is 12 rd. and altitude 6 rd., drawing to a scale of $\frac{1}{2}$ in. to a rod.   Find its area.

3. Compare the area of the above triangle with the area of a rectangle 12 rd. long and 6 rd. wide.

4. The length of a rectangle is 80 rd.   The length of its perimeter 220 rd.   Find the width of the rectangle, and its area.   Draw a diagram on a scale of 1 in. to 20 rd.

5. How many square yards of paper will be needed to cover the walls and ceiling of a room 18 ft. long, 15 ft. wide, and 12 ft. high?

6. At 3¢ a square foot, how much will it cost to sod a lawn 2 rods square?

7. Draw a diagram representing a triangle whose area is 24 sq. in.

8. Draw a diagram representing a triangle whose area is 1 acre.

9. Draw a rectangle representing an area of 2 acres.

10. How wide must a board 16 ft. long be to contain 12 sq. ft.?

11. How much will it cost, at 12¢ a square foot, to lay a sidewalk, 8 ft. wide, around a rectangular plot of ground 1000 ft. by 600 ft.?

12. Show by a diagram the difference between 3 inches square and 3 square inches.

13. How many square feet of land are there in a building lot 25 ft. wide at one end, 20 ft. at the other, and 200 ft. deep?

LESSON 116

A **Circle** is a plane figure bounded by a curved line, called its **Circumference**, every part of which is equally distant from a point within, called the center.

The **Diameter** of a circle is a straight line drawn from any point in the circumference, through the center, and terminating in the circumference opposite, as *AB*.
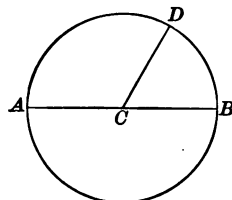
The **Radius** of a circle is a straight line drawn from the center to the circumference, as *CD*.

1. Draw on the blackboard a circle having a diameter 7 in. long. With the aid of a string, or tape line, get the length of the circumference of your circle. Divide the circumference by the diameter. Do you find that the circumference is about $3\frac{1}{7}$ times the diameter?

2. Can you tell how to find the circumference when the diameter is given?

3. Find the circumference when the diameter is 8 inches; 12 inches; 24 feet; 20 yards; 12 rods.

4. Find the circumference when the radius is 3 inches; 5 inches; $2\frac{1}{2}$ yards; 1.75 rods.

5. If the circumference equals the diameter multiplied by $3\frac{1}{7}$, how would you find the diameter when the circumference is given?

6. Find the diameter when the circumference is 44 inches; 66 feet; 90.2 yards; 11,044 rods.

7. Find the circumference of a circle whose diam. is 1 rd.

8. What is the diameter of a circle whose circumference is $18\frac{6}{7}$ feet?

LESSON 117

Area of a Circle.   The area of a circle can be found by multiplying the circumference by one half of the length of the radius.
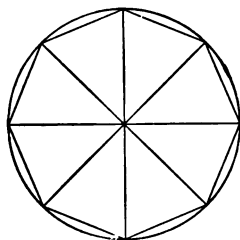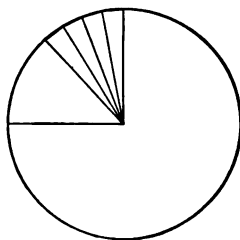

FIG. 1   FIG. 2

According to this rule, we regard the area of the circle as equal to the sum of the areas of a number of equal triangles.   If there were only eight of these triangles, as in Fig. 1, it is evident there would be considerable difference between the sum of the areas of the triangles and that of the circle.   But if the number of triangles were increased to thirty-two, as in Fig. 2, the sum of the areas of the triangles would approach much nearer the area of the circle.

If the number of triangles were still further increased, they would form a plane figure that could hardly be distinguished from the circle. Now the sum of the areas of the triangles can be found by multiplying the sum of their bases by one half of their altitude.   Therefore the area of a circle can be found by multiplying its circumference by one half of its radius.

Suppose the radius of a circle to be 3 inches.

Then the circumference = $3 \times 2 \times 3\frac{1}{7} = 18\frac{6}{7}$ in.

And the area = $18\frac{6}{7} \times \frac{1}{2}$ of $3 = 18\frac{6}{7} \times \frac{3}{2} = 28\frac{2}{7}$ sq. in.

1. Find the areas of the following circles when the radius is 3 in.; 5 in.; 8 in.; 5.5 feet; 6.25 rods.
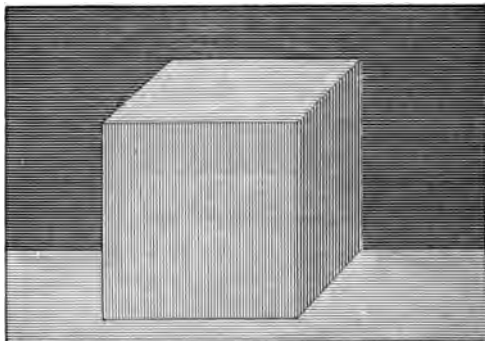
2. Find the areas of the following circles when the diameter is 10 in.; 14 ft.; 28 yd.; 16.8 rd.

3. Find the circumference of a circle whose diameter is 42 feet. Find the area.

4. A horse is tied to a tree by a rope 20 ft. long. Over what area can he pasture ?

5. What is the area of a circle whose circumference is ½ of a mile ?

LESSON 118

THE CUBE

1. How many sides, or faces, has the cube ? Of what shape are they ? How do the six faces compare in size ?

2. How many edges has the cube ? How many corners ?

3. How many edges bound each face ? Does each edge form a part of the boundary of more than one face ? If so, of how many faces ?

**4.** How many corners has each face of the cube ?

5. How many faces of a cube are parallel to any one face ? How many edges are parallel to any one edge ?

The figure above represents a cubic inch.

A cubic inch is a cube each of whose edges is one inch long.

For definition of cube, see p. 108.

6. How high is a cubic foot? How wide? How long?

7. Define a cubic foot.

8. Define a cubic yard.

9. What is the area of a cubic inch?

10. What is the area of a cube each of whose edges is 2 in. long?

11. What is the area of a cube each of whose edges is 4 in. long?

2 in.

2 in.

4 in.
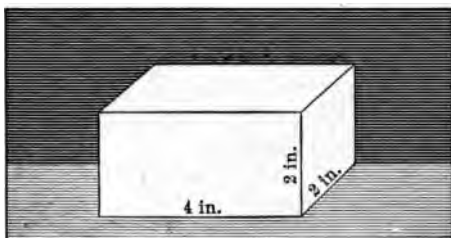
RECTANGULAR SOLID

A solid bounded by six rectangular faces is called a **Rectangular Solid.**

12. How many edges has this figure? How many corners?

13. In what particular respect does the above figure resemble the cube? In what respect does it differ from the cube?

14. If the above figure is 4 in. long, 2 in. high, and 2 in. wide, what is the area of one end? Both ends? What is the area of one side? Of the four sides? What is the total area?

SOLIDS

LESSON 119

The **Volume** of a solid is the number of cubic units which it contains.

The principal English cubic units are the *cubic inch*, *cubic foot*, and the *cubic yard*.

A solid 1 unit long, 1 unit wide, and 1 unit high contains 1 cubic unit.
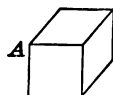
A solid 2 units long, 1 unit wide, and 1 unit high contains 2 cubic units.
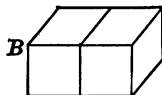
A solid 3 units long, 1 unit wide, and 1 unit high contains 3 times 1, or 3 cubic units.
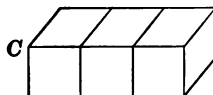
A solid 3 units long, 2 units wide, and 1 unit high contains 3 times 2, or 6 cubic units.
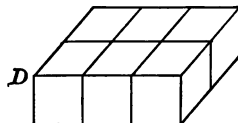
A solid 3 units long, 2 units wide, and 2 units high contains 3 × 2 × 2, or 12 cubic units.
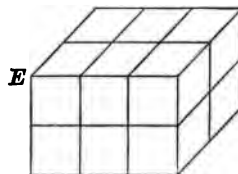
If *A* is a cubic inch, the volume of *B* is 2 cu. in.; *C* is 3 cu. in., etc.

1. Considering *A* a cubic foot, what is the volume of *D* ? Of *E* ?

2. If *A* is a cubic yard, what is the volume of *D* ? How many cubic yards are there in one layer of *E* ? In both layers ?

3. If we suppose the figure in the margin to represent a solid 5 ft. long, 3 ft. wide, and 4 ft. high, what is the cubic unit of measure?

4. Count the number of cubic feet in the top layer. How many are there?

5. Can you say that the top layer has 5 rows with 3 cubic feet in each row?

6. Is it also true that it has 3 rows with 5 cubic feet in each row?

7. The height is 4 feet. How many layers of cubic feet, therefore, are there in the height?

8. What is the total number of cubic feet in the volume of the figure?

9. Can you give a rule for calculating the volume of a solid when you know the three dimensions?
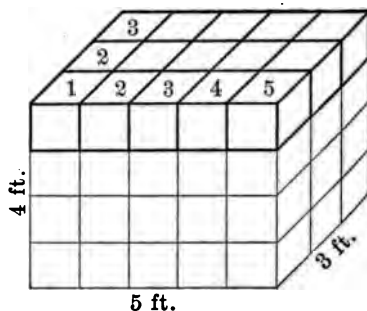
LESSON 120

1. How many cubic inches are there in a brick 8 in. long, 4 in. wide, and 2 in. thick?

2. How many cubic inches are there in a solid 5 ft. long, 4 ft. wide, and $2\frac{1}{2}$ ft. thick?

3. How many cubic feet are there in a cube each edge of which is 3 ft.? What is the name of such a cube?

4. How many cubic inches of sand will a box hold that is 5 in. long, 4 in. wide, and $3\frac{1}{2}$ in. deep?

5. How many cubic inches are there in a solid 5 ft. square at the base, and 3 ft. high?

6. What is the volume of a cube whose edge is 5 in. ?

7. How many cubic inches can be cut from a cube whose edge is 4 in. ?

8. How many cubic feet are there in a solid 4 ft. long, 3 ft. wide, and $2\frac{3}{4}$ ft. high?

9. How many square feet of paper will be needed to cover a cube whose edge is 3 ft. ?

10. If the cube mentioned in the preceding question be cut into cubic feet, would it require the same amount of paper to cover the smaller cubes? If not, how much more paper would be needed in the one case than in the other?

11. How many 1-inch cubes can be covered with a sheet of paper 12 in. square?

12. How many 2-inch cubes can be covered with a sheet of paper 2 ft. square?

LESSON 121

1. Which will hold the more, 2 boxes each 14 in. long, 10 in. wide, and 6 in. deep, or 4 boxes each 7 in. long, 5 in. wide, and 3 in. deep?

2. How many cubic feet and cubic inches are there in 3990 cu. in. ?

3. How many cubic yards and cubic feet in 800 cu. ft. ?

4. There are 231 cu. in. in a gallon. How many gallons will a tin box hold that is 11 in. long, 7 in. wide, and 3 in. deep?

5. How many gallons will a box hold that is 22 in. long, 14 in. wide, and 6 in. deep?

6. How many bricks 8 in. × 4 in. × 2 in. would be needed for a wall 10 ft. long, 6 ft. high, and 1 ft. thick?

7. Find the volume of a solid 10 in. long, 6 in. wide, and 4 in. thick. How many square inches in its surface?

The unit in **Wood Measure** is the *cord*.

It consists of a pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high, and therefore contains $8 \times 4 \times 4$, or 128 cu. ft.
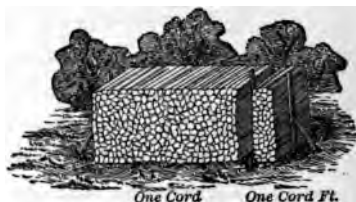
The *cord foot* is one foot in length of such a pile, or 16 cu. ft.

8. A cord foot is what part of a cord?

9. How many cord feet make a cord?

10. How many cord feet are there in 32 cu. ft.? In 48 cu. ft.?

11. 48 cu. ft. equal what part of a cord?

LESSON 122

1. How many cords are there in a pile of wood 24 ft. long, 12 ft. high, and 4 ft. wide?

The number of cubic feet in the pile $= 24 \times 12 \times 4$, or 1152. Dividing 1152 by 128, the number of cubic feet in a cord, we get 9, the number of cords.

OPERATION

$24 \times 12 \times 4 = 1152$ cu. ft. in pile.

$1152 \div 128 = 9$ cords.

2. How many cubic feet are there in a pile of wood 32 ft. long, 4 ft. wide, and 4 ft. high? How many cord feet? How many cords?

3. How many cords of wood are there in a pile 32 ft. long, $9\frac{1}{2}$ ft. high, and 4 ft. wide? How much is the wood worth at $4 a cord?

4. How many cords of wood can be put into a shed 24 ft. long, 16 ft. wide, and 12 ft. high? How much is the wood worth at $4.50 a cord?

5. Find the number of cubic yards of earth that will have to be removed in digging a cellar 24 ft. long, 18 ft. wide, and 6 ft. deep. What will be the cost at 30 ¢ a load (1 cu. yd.)?

The unit in **Board Measure** is the *board foot*. The board foot is a square foot *one inch* thick.

6. How many board feet are there in a piece of board 2 ft. long, 1 ft. wide, and 1 in. thick?

7. Find the number of board feet in a board 15 ft. long, 16 in. wide, and 1 in. thick.

The shape of the board is that of a rectangle. To find the area of a rectangle we multiply the length by the width.

OPERATION

$16 \div 12 = 1\frac{1}{3}$, width of board in ft.

$1\frac{1}{3} \times 15 = 20$ board feet.

A board $1\frac{1}{4}$ in. thick contains $1\frac{1}{4}$ times as many board feet as a board 1 in. thick, and a board $1\frac{1}{2}$ in. thick contains $1\frac{1}{2}$ times as many.

8. Find the number of board feet in a board 18 in. wide, 16 ft. long, and $1\frac{1}{4}$ in. thick.

Since the board is $1\frac{1}{4}$ in. thick, it contains $1\frac{1}{4}$ times as many board feet as a board 1 inch thick.

OPERATION

$18 \div 12 = 1\frac{1}{2}$, width of board in ft.

$1\frac{1}{2} \times 16 \times 1\frac{1}{4} = 30$ board feet.

9. How many board feet are there in a board 2 ft. long, 6 in. wide, and 1 in. thick?

10. How many board feet are there in a board 2 ft. long, 1 ft. wide, and 2 in. thick?

LESSON 123

1. How many board feet equal a cubic foot?

2. How many board feet are there in a board 12 ft. long, 1 ft. wide, and 2 in. thick? How many cubic feet?

3. A board 6 ft. long, 1 ft. wide, and 1 in. thick is what part of a cubic foot?

4. How many board feet are there in a board 8 ft. long, 1 ft wide, and $1\frac{1}{2}$ in. thick?

5. How many board feet are there in a board 10 ft. long, 1 ft. wide, and 2 in. thick?

6. How many cubic feet are there in a board 16 ft. long, 1 ft. wide, and 1 in. thick?

7. How many board feet equal 4 cubic feet? 6 cubic feet?

8. 5 cubic feet equal how many board feet?

9. How many board feet are there in a board 18 in. wide and 12 ft. long?

10. How many board feet are there in a board 15 in. wide, 16 ft. long, and 1 in. thick? In a board 15 in. wide, 20 ft. long, and $1\frac{1}{2}$ in. thick?

11. Find the number of cords in a pile of wood 32 ft. long, 8 ft. high, and 4 ft. wide. Find the cost of the wood at $5.60 a cord.

12. How many board feet are there in 12 boards, each 16 ft. long, 1 ft. wide, and 1 in. thick?

13. Find the number of board feet in 25 boards, each 12 ft. long, 18 in. wide, and 1 in. thick.

14. Find the cords in a pile of wood 40 ft. long, 12 ft. high, and $4\frac{1}{2}$ ft. wide.

INTEREST

LESSON 124

If you use land or a house belonging to another person, the money you pay for the privilege is called rent.

If you obtain the use of another's money, the sum you pay for its use is called **Interest**. The money loaned is called the **Principal**. Interest is always calculated at a certain *per cent* of the principal for *one year*, unless otherwise stated.

For example, interest at 6% means that the interest for *one year* is 6% of the principal.

Interest at 5% means that the interest for *one year* is 5% of the principal.

If I borrow $1 for a year and agree to pay 6% interest, I must pay 6% of $1.00, or $\frac{6}{100}$ of $1.00, or 6¢ interest.

1. If I pay 6¢ for the use of $1 for 1 year, how much interest must I pay if I keep it 2 yr.? 3 yr.? 4 yr.? 5½ yr.?

2. If the interest of $1 for 1 yr. is 6¢, how much is the interest of $5 for a year? 2 yr.? 3 yr.? 4½ yr.?

3. If the interest of $1 for 1 yr. is 6¢, how much is the interest of $10? $12? $2½?

4. At 4%, what is the interest of $1 for 1 yr.? 2 yr.? 3 yr.? 3½ yr.?

5. At 6%, what is the interest of $4 for 1 yr.? 3 yr.? 2½ yr.?

6. What is 6% of $100? $200? $300? $250?

7. What is the interest of $100 for 1 yr. at 6%? For 2 yr.? For 6 mo. (½ yr.)?

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8. What is the interest of $1 for 1 yr. at 5%? For 2 yr.? For 6 mo.?

9. At 5%, how many dollars must I lend to receive 50¢ interest at the end of a year?

10. At 7%, how many dollars must be on interest to yield $1.40 interest?

LESSON 125

1. What is the interest of $40 for 3 yr. at 5%?

MODEL. $5\% = \frac{5}{100}$, or $\frac{1}{20}$.
The interest for 1 yr. $= \frac{1}{20}$ of $40, or $2.
The interest for 3 yr. $= 3$ times $2, or $6.

2. Find the interest of $60 for 4 yr. at 5%.
3. Find the interest of $80 for 3 yr. at 5%.
4. Find the interest of $75 for 2 yr. at 4%.
5. Find the interest of $100 for 3 yr. at 4%.
6. Find the interest of $200 for 4 yr. at 4%.
7. Find the interest of $100 for 2 yr. at 6%.
8. Find the interest of $300 for 3 yr. at 6%.

9. Find the interest of $200 for 3 yr. 6 mo. ($3\frac{1}{2}$ yr.) at 6%.

10. Find the interest of $200 for 2 yr. 8 mo. ($2\frac{2}{3}$ yr.) at 6%.

11. Find the interest of $200 for 2 yr. 9 mo. ($2\frac{3}{4}$ yr.) at 6%.

12. What is the interest of $800 for 1 yr. at 4%? At 5%? At 3%?

13. What is the interest of $600 for 2 yr. 6 mo. at 3%? For 2 yr. 4 mo.? For 2 yr. 8 mo.? For 2 yr. 10 mo. ($2\frac{5}{6}$ yr.)?

14. Find the interest of $850 for 2 yr. at 6%.

MODEL.   6% = .06.
The interest for 1 yr. = $850 × .06 = $51.
The interest for 2 yr. = $51 × 2 = $102 *Ans.*

15. Find the interest of $600 for 3 yr. at 6%.   At 5%.
At 5½%.

16. Find the interest of $250 for 4½ yr. at 5%.   At 6%.
At 4½%.

17. Find the interest of $400 for 1 mo. at 6%.

MODEL.   1 mo. = $\frac{1}{12}$ yr.
$400 × .06 = $24 = interest for 1 yr.
$\frac{1}{12}$ × $24 = $2 = interest for 1 mo.

18. Find the interest of $300 for 3 mo. at 6%.   At 4½%.
At 5%.

19. Find the interest of $425 for 5 mo. at 6%.

20. Find the interest of $1000 for 9 mo. at 5%.   At 6%.

21. Find the interest of $2000 for 10 mo. at 5%.   At 6%.

LESSON 126

The **Amount** is the sum of the principal and interest.

1. Find the amount of $480 for 2 yr. at 6%.

MODEL. $480 × .06 = $28.80 = interest for 1 year.
$28.80 × 2 = $57.60 = interest for 2 yr.
$480 + $57.60 = $537.60, Amount.

2. Find the amount of $400 for 3 yr. at 5%.

3. Find the amount of $650 for 2½ yr. at 6%.

4. Find the amount of $350 for $3\frac{1}{2}$ yr. at 4%.

5. Find the amount of $200 for 2 yr. 4 mo. at 6%.

6. Find the amount of $600 for 2 yr. 6 mo. at 5%.

7. Find the amount of $700 for 3 yr. 8 mo. at 6%.

By the *common method* of reckoning interest it is customary to regard 30 days as a month and 360 days as a year.

8. Find the interest of $500 for 3 yr. 5 mo. 15 da. at 6%.

MODEL.   15 days = $\frac{15}{30}$, or $\frac{1}{2}$ mo.

                3 yr. 5 mo. = 41 mo..

            3 yr. 5 mo. 15 da. = $41\frac{1}{2}$ mo.

      $500 × .06 = $30 = interest for 1 yr.

      $30 ÷ 12 = $2.50 = interest for 1 mo.

   $2.50 × $41\frac{1}{2}$ = $103.75 = interest for 3 yr. 5 mo. 15 da.

9. Find the interest of $600 for 2 yr. 7 mo. 20 da. at 5%.

MODEL.   Time reduced to months = $31\frac{2}{3}$ mo.

         $600 × .05 = $30 = interest for 1 yr.

         $30 ÷ 12 = $2.50 = interest for 1 mo.

      $2.50 × $31\frac{2}{3}$ = 79.16\frac{2}{3}$ = interest for 2 yr. 7 mo. 20 da.

10. Find the interest of $560 for 2 yr. 5 mo. 25 da. at 5%.

11. Find the interest of $325 for 4 yr. 3 mo. 18 da. at 4%.

12. Find the interest of $450 for 2 yr. 10 mo. 10 da. at 6%.

13. Find the interest of $725 for 3 yr. 7 mo. 6 da. at 4%.

14. Find the interest of $840 for 2 yr. 11 mo. 5 da. at 5%.

REVIEW WORK

LESSON 127

1. How many board feet are there in a board 20 ft. long, 12 in. wide, and 2 in. thick?

2. How many acres are there in a triangular piece of land whose base is 320 yd. and whose altitude is 242 yd.?

3. Find the value, at $50 an acre, of a triangular field whose base is 16.5 ch. and whose altitude is 14.4 ch.

4. How much is a pile of wood worth at $4¾ a cord, if the pile is 16 ft. long, 8 ft. wide, and 4 ft. high?

5. When the length, breadth, and depth of a rectangular solid are given, how do you find its volume?

6. Give the rule for finding the area of a triangle.

7. Find the cost of 33 ft. of wire fencing at $1.20 a rod.

8. 33⅓% of 2 sq. yd. equals how many square feet?

9. 3 sq. yd. is what part of 3 yd. sq.?

10. Change to decimals and add: $\frac{3}{16}, \frac{9}{20}, \frac{5}{80}, \frac{5}{8}, \frac{3}{4}$.

11. Find the sum of 6.009, .06⅛, .3⅞, 6⅖.

12. A single roll of wall paper is 24 ft. long and 18 in. wide. How many square yards does it contain?

13. A double roll of wall paper is 48 ft. long, and 18 in. wide. How many square feet does it contain?

14. How many double rolls of paper will be needed for a ceiling 18 ft. by 20 ft.?

15. How many strips of ingrain carpet (1 yd. wide) will it take to cover a floor 22 ft. long by 18 ft. wide, if the carpet is laid crosswise? How many yards will be needed?

16. If 21 cans of tomatoes cost $2.52, how much will 7 cans cost?

LESSON 128

1. What is the unit in Liquid Measure? How many cubic inches in a gallon?

2. Allowing $7\frac{1}{2}$ gallons to equal one cubic foot, what is the capacity of a 10 gallon keg?

3. If $\frac{3}{4}$ lb. of tea costs $\$\frac{1}{2}$, how many pounds can be bought for $\$15$?

4. A cubic foot of pure water weighs $62\frac{1}{2}$ lb. Find the weight of the water that will fill a tin box 2 ft. long, 18 in. wide, and 8 in. deep.

5. What part of an acre is a lot 8 rd. long and 4 rd. wide?

6. If $\frac{3}{4}$ of the quantity of onions costs $\$6\frac{2}{5}$, what is the price of the whole quantity?

7. 25% of a pound = how many ounces? 50% of a rod = how many feet? $66\frac{2}{3}\%$ of a square foot = how many square inches?

8. If a man loses $37\frac{1}{2}\%$ of his money, what $\%$ of his money has he left? How many eighths of his money has he left?

9. Draw a rectangle 4 in. long and 2 in. wide, and show 75% of it.

10. Which will hold the more, 4 cubical boxes with 5-inch edges, or 5 cubical boxes with 4-inch edges?

11. Find the perimeter of a rhombus whose edge is 5 ft. 6 in.

12. What is the area of a circle whose radius is 10 ft.?

13. If I buy lemons at $16\cent$ a dozen, and sell them at the rate of 3 for $5\cent$, how much is my profit on 150 lemons?

LESSON 129

1. How many gills are there in 8 gal. 2 qt. 1 pt. 2 gi.?

2. What is the value of a pile of wood 96 ft. long, 4 ft. wide, and 6 ft. high, at $3⅘ a cord?

3. If 56 men can do a piece of work in 21 days, how long will it take 28 men to do it?

4. A butcher bought a number of sheep for $1040, and sold them for $1430. If he gained $1.50 on each sheep, how many did he buy?

5. Divide 8763⅛ by 22.

6. If 5⅓ tons of coal cost $32, how much will 3.66⅔ tons cost?

7. How many board feet are there in a board 18.25 ft. long, 2.8 ft. wide, and 1 in. thick?

8. Divide 94.5 by .126. Multiply .039 by .0009.

9. I bought a quantity of grain for $500, and sold it at a loss of 5%. How much did I receive for it?

10. A farmer sold ½ of his potatoes at one time, and ⅓ at another, and had 48 bu. left. How many bushels had he at first?

11. If .75 of a ton of straw is worth $13.50, how much are 8.25 tons worth?

12. Find the perimeter of a rectangle 8½ ft. long and 6 in. wide. Find the area.

13. What is the least common multiple of 7 and 6?

14. Name three numbers of which 7 is the greatest common divisor.

TABLES

Long Measure is used in measuring lines or estimating distances. The unit of long measure is the *yard*.

TABLE

12 inches = 1 foot (ft.)
3 feet = 1 yard (yd.)
5¼ yards, or 16½ ft. = 1 rod (rd.)
320 rods = 1 mile (mi.)
1 mi. = 1760 yd. = 5280 ft. = 63360 in.

SURVEYORS' LINEAR MEASURE

Surveyors' Linear Measure is used by surveyors and engineers in measuring distances, as roads, dimensions of land, etc. The unit is the *chain*.

TABLE

7.92 inches = 1 link (li.)
25 links = 1 rod
4 rods, or 100 links = 1 chain (ch.)
80 chains = 1 mile

SQUARE MEASURE

Square Measure is used in measuring surfaces, as land, paving, plastering, boards, etc.

TABLE

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards, or } = 1 square rod, or perch
272¼ square feet }
160 square rods, or perches = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

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CUBIC, OR SOLID MEASURE

Cubic, or **Solid Measure** is used in measuring the contents of solids or bodies; as wood, stone, etc.

TABLE

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
16 cubic feet = 1 cord foot (cd. ft.)
8 cord feet, or ⎫
128 cubic feet ⎬ = 1 cord of wood

LIQUID MEASURE

Liquid Measure is used in measuring nearly all kinds of liquids. The standard unit of liquid measure is the *gallon*, which contains 231 cubic inches.

A pint of water weighs about one pound.

A cubic foot of distilled water weighs about 1000 ounces, avoirdupois weight.

TABLE

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
31½ gallons = 1 barrel (bbl.)
63 gallons = 1 hogshead (hhd.)

DRY MEASURE

Dry Measure is used in measuring grain, fruit, lime, etc. The standard unit of dry measure is the *bushel*. It contains 2150.42 cubic inches.

TABLE

2 pints = 1 quart
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Grains, seeds, and small fruits are sold by stricken measure; that is, the measure must be even full.

Coarse vegetables, large fruits, and bulky articles, such as potatoes, turnips, apples, etc., are sold by heaped measure. In practice we say 5 stricken measures equal 4 heaped measures.

TROY WEIGHT

Troy Weight is used in weighing jewels and the precious metals, as gold and silver. The unit of weight is the *pound*, which contains 5760 grains.

TABLE
24 grains = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce (oz.)
12 ounces = 1 pound (lb.)

The *carat* is a unit of 4 imaginary grains employed in rating diamonds and precious stones, as the ruby, topaz, emerald, etc. The term is also used to express the fineness of gold. Thus, gold 18 carats fine consists of 18 parts pure gold, alloyed with 6 parts of some other metal, the whole mass being divided into 24 equal parts.

AVOIRDUPOIS WEIGHT

Avoirdupois Weight is used in weighing nearly everything except gold, silver, and jewels. The unit of weight is the *pound*. It contains 7000 Troy grains.

TABLE
16 ounces = 1 pound
100 pounds = 1 hundredweight (cwt.)
20 hundredweight = 1 ton (T.)

APOTHECARIES' WEIGHT

Apothecaries' Weight is used by physicians and apothecaries in prescribing and preparing dry medicines. The unit is the *pound*, which contains 5760 gr., like the Troy pound.

Medicines are bought and sold by avoirdupois weight.

TABLE

20 grains = 1 scruple (Ə)

3 scruples = 1 dram (Ʒ)

8 drams = 1 ounce (℥)

12 ounces = 1 pound (℔)

TIME

The unit of time is the *day*.

TABLE

60 seconds (sec.) = 1 minute (min.)

60 minutes = 1 hour (hr.)

24 hours = 1 day (da.)

7 days = 1 week (wk.)

365 days = 1 common year (yr.)

366 days = 1 leap year

100 years = 1 century (cen.)

UNITED STATES MONEY

Money is the measure of the value of articles bought, sold, or exchanged.

TABLE

10 mills (m.) = 1 cent (¢ or ct.)

10 cents = 1 dime (d.)

10 dimes = 1 dollar ($)

10 dollars = 1 eagle (E.)

English Money, sometimes called sterling money, is the legal currency of Great Britain.   The unit is the *pound sterling;* but there is no coin known by this name, the value being represented by the gold sovereign, a coin equal to 20 shillings sterling, or $4.8665 of United States money.

TABLE
4 farthings (far.) = 1 penny (*d.*)
12 pence = 1 shilling (*s.*)
20 shillings = 1 pound (£)

COUNTING
12 units = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
12 gross = 1 great gross (grt. gro.)
20 units = 1 score (sc.)

PAPER
24 sheets = 1 quire (qr.)
20 quires (480 sheets) = 1 ream (rm.)
2 reams = 1 bundle (bun.)
5 bundles = 1 bale (B.)

ANSWERS

Page 11.—**9.** $1248507. **10.** $12200646. **11.** $79.83. **12.** $33.539. **13.** $251.026.

Page 12.—**14.** 37\frac{1}{4}$. **15.** $37.50. **16.** 22\frac{1}{12}$. **17.** 22.08\frac{1}{4}$. **18.** 28$\frac{1}{4}$. **19.** 64.45. **20.** 36.768. **21.** 29.91. **22.** 45328. **23.** 71288802. **24.** 3271.9. **25.** 98536.88. **26.** 1253.243.

Page 13.—**5.** 4$\frac{1}{4}$. **6.** 1$\frac{1}{2}$. **7.** 6$\frac{1}{4}$. **8.** 4$\frac{1}{4}$. **9.** 5$\frac{5}{8}$. **10.** $\frac{6}{10}$. **11.** .6. **12.** 1.2. **13.** 7.6. **14.** $\frac{1}{10}$. **15.** 8$\frac{11}{12}$. **16.** 3$\frac{1}{4}$.

Page 14.—**1.** 869. **2.** 3888. **3.** 28078. **4.** $126.66. **5.** $202.369. **6.** 15$\frac{1}{4}$. **7.** 26. **8.** 9$\frac{1}{4}$. **9.** 15$\frac{1}{4}$. **10.** 2.16\frac{2}{4}$. **11.** 2.19. **12.** 13.38$\frac{1}{4}$. **13.** 343.7. **14.** 566.58. **15.** 4005.936. **16.** $30.37. **17.** 260$\frac{11}{12}$ A. **18.** $\frac{1}{2}$¢. **19.** 2.62\frac{1}{2}$. **20.** 184$\frac{2}{3}$ rd. **21.** 9$\frac{9}{10}$ A. **22.** 13$\frac{1}{3}$ ft. **23.** 198.42. **24.** 206.26.

Page 15.—**18.** 6. **19.** 14$\frac{5}{8}$. **20.** 8.4. **21.** 21$\frac{11}{12}$. **22.** 2$\frac{11}{12}$. **23.** 28.15. **24.** 16$\frac{3}{4}$ bu. **25.** $\frac{1}{12}$. **26.** 47$\frac{1}{8}$ T.

Page 17.—**1.** 4657725. **2.** 196545160. **3.** 5234923624. **4.** $149837.6608. **5.** 7383.8786. **6.** 28. **7.** 6. **8.** 66. **9.** 78. **10.** 16. **11.** 73.6. **12.** .24. **13.** 70.2. **14.** 62.5. **15.** 7.5. **16.** $123.55. **17.** $267.36. **18.** $675.54. **19.** 255.75. **20.** 37.5. **21.** 51000 lb. **22.** 744 hr.; 672 hr. **23.** $171.825. **24.** $15. **25.** $2.50. **27.** 275 qt. **28.** 52$\frac{1}{2}$¢. **29.** 137 sq. yd. **30.** 131 yd. 6 in. **31.** 54 sq. ft.

Page 19.—**1.** 26.. **2.** 70. **3.** 8637. **4.** 4268. **5.** 245. **6.** $245. **7.** $2.45. **8.** 245. **9.** 24500. **10.** 245. **11.** 187. **12.** 194. **13.** 276. **14.** 530. **15.** 86. **16.** 100 bu.; 120 bu.; 143 bu. **17.** 9. **18.** 96. **19.** 9 rd. 1$\frac{1}{2}$ yd. 1 ft. 8 in. **20.** $16.40. **21.** 12. **22.** 20 ft. **23.** 168 yd. **24.** 48 reams. **25.** 7 bu. 1 pk. 2 qt. **26.** 16.3 T. **27.** 44.6 mi.

Page 21.—**1.** 525948.5 min. **2.** $4.50. **3.** 21\frac{7}{8}$. **4.** $1.95. **5.** 30.62\frac{1}{2}$. **6.** $39. **7.** 8.38\frac{1}{4}$. **8.** 17\frac{1}{4}$. **9.** 9.56\frac{1}{4}$. **10.** 2.62\frac{1}{2}$. **11.** 27 da. **12.** $40; $150. **13.** $50. **14.** $10.67. **15.** $2.86.

Page 23.—**1.** 15$\frac{1}{12}$ yd. **2.** 9¢. **3.** 16$\frac{2}{3}$. **4.** 30 sq. yd. **5.** 17$\frac{1}{4}$ mi. **6.** $64.80. **7.** 29. **8.** 720 sq. ft.

Page 24.—9. 384¼ ft. **10.** 3½ hr. **11.** 2¼. **12.** 2¼. **13.** 2¼. **14.** 2¼. **15.** 1⅞. **16.** 2. **17.** 2⅝. **18.** 2 1/10. **19.** 3¼. **20.** 5⅔. **21.** 5¼. **22.** 3¼.

Page 25.—1. 105 yd. **2.** $10. **3.** ⁷⁄₅; 1⅖; 2⅕; 1⅘. **4.** 2⅖; 1⅖; 5⅖; 7⅕. **5.** 16½; 43; 36; 51; 16; 49; 44. **6.** 160 da. **7.** 86.686.

Page 26.—8. 68.48. **9.** 101.48. **10.** 11.83. **11.** 4.32. **12.** 4.34. **13.** 7.52. **14.** 37.4. **15.** 23.49. **16.** 127.4. **17.** 66 sq. yd. **18.** 9 mi.; 15840 yd.; 47520 ft. **19.** 167 da. **20.** 96. **21.** $263.90. **22.** $35.625. **23.** $103.80. **24.** $5.769. **25.** $166.32. **26.** $60.75. **27.** $2556. **28.** 42¢. **29.** 24 pairs. **30.** $3.33. **31.** $3.10.

Page 30.—2. 8. **3.** 12. **4.** 8. **5.** 8. **6.** 4. **7.** 24. **8.** 15. **9.** 16. **10.** 5.

Page 36.—2. 72. **3.** 144. **4.** 96. **5.** 280. **6.** 378. **7.** 120. **8.** 88. **9.** 756. **10.** 1080. **11.** 2; 4; 12; 16; 5; 24. **13.** 36; 63; 84; 120; 105; 90.

Page 37.—15. 6.48. **16.** 2.142. **17.** 2.064. **18.** 3.67. **19.** 25.2036. **20.** .11. **21.** 2.4. **22.** 2.03. **23.** 200.5. **24.** 150.05. **25.** 74½. **26.** 7.44. **27.** 88½. **28.** 342. **29.** $1.089. **30.** 8167½ sq. yd.; 66 sq. rd.; $196.02. **Lesson 31.**—19. 100 yd.; 1000 yd. **20.** 60.

Page 38.—21. 36. **22.** 48. **Lesson 32.**—1. 96 rd.; $153.60. **2.** $1.98.

Page 39.—3. 8 mi. 160 rd. 1 yd. **4.** 73 yr. 2 mo. 5 da. **5.** $499.20. **6.** $634996.82. **7.** $901,866,163.95. **8.** 10 mi. **9.** 144 yd. **10.** 2880. **11.** 8.3; 137.4. **12.** 211.25; 59.15; 5.07. **13.** 100 doz. **14.** 153 doz. **15.** 321 sheets. **16.** $170.64.

Page 40.—4. 18. **5.** 70.

Page 41.—6. 12. **7.** 144. **8.** 4. **9.** 3. **11.** ⁵⁄₁₅. **12.** ⅜. **13.** ¹⁄₁₆₁. **14.** ⁷⁄₂₇. **15.** 162. **16.** 12. **17.** 6¼. **18.** 1350. **20.** 4¾ wk. **21.** $21. **22.** 62 lb.

Page 44.—44. 2½; 3; 4; 4½; $6; $66; $5. **45.** 2; 3 rd; 4 T.; 6 A.; 8 mi. **46.** $120; $300.30; 108 calves; 3.51 yd.; $.54. **47.** $120; 240 gal.; 160 cows; $292.64; 620 oz. **48.** $.08; $.18; 120 in.; .004 ft.; 5.08 da. **49.** 280 yd.; $14.70; 42.7 qt.; 525 yd. **50.** $400; $8; 15.5 pk.; .5 A.; .155 pt. **Lesson 36.**—2. 182.4 yd. **3.** 220.5 hr. **4.** 395.6 gal. **5.** $403.20. **6.** 167.2 bu. **7.** $163.40. **8.** 246.4 A. **9.** 104 sheep. **10.** 90 mi. **11.** 140 in. **12.** $81. **13.** $130.

Page 45.—14. 640 bu. **15.** $1200. **16.** 108 da. **17.** $448. **18.** $56; 44 rd.; 8.4 gal.; 24.6 cents. **19.** $16128. **20.** $56. **21.** $202.50. **22.** 8000 A.

Page 47.—2. ²⁵⁵⁄₁₆; ³⁵⁴⁄₁₂; ¹⁴⁰⁰⁄₄₀; ⁴⁹⁵⁄₉. **4.** 2¼; 11⅓; 17⅝; 8⁶⁹⁄₁₉. **6.** 2⁴¹⁄₂. **8.** 29⅔; 141; 21; 31 rd.; 24½ ft.

Page 48.—7. $\frac{2}{3}$; $\frac{2}{3}$; $\frac{4}{5}$; $\frac{2}{3}$; $\frac{2}{3}$; $\frac{5}{24}$; $\frac{1}{4}$; $\frac{9}{16}$; $\frac{1}{4}$; $\frac{1}{7}$; $\frac{5}{8}$.

Page 50.—2. $\frac{15}{10}$, $\frac{50}{10}$, $\frac{42}{10}$. **3.** $\frac{48}{8}$, $\frac{9}{8}$, $\frac{7}{6}$. **4.** $\frac{24}{6}$, $\frac{45}{6}$, $\frac{48}{6}$. **5.** $\frac{34}{4}$, $\frac{44}{4}$, $\frac{74}{4}$.
6. $\frac{45}{6}$, $\frac{24}{6}$, $\frac{31}{6}$. **7.** $\frac{141}{42}$, $\frac{30}{42}$, $\frac{48}{42}$. **8.** $\frac{45}{8}$, $\frac{42}{8}$, $\frac{35}{8}$. **9.** $\frac{31}{6}$, $\frac{16}{6}$, $\frac{38}{6}$. **10.** $\frac{24}{4}$, $\frac{24}{4}$, $\frac{7}{4}$.

Page 52.—2. $2\frac{2}{3}$. **3.** $1\frac{7}{12}$. **4.** $1\frac{5}{16}$. **5.** $1\frac{103}{240}$. **6.** $1\frac{34}{44}$. **7.** $2\frac{45}{55}$.
8. $1\frac{21}{46}$. **9.** $1\frac{14}{15}$. **10.** $2\frac{15}{112}$. **11.** $1\frac{41}{132}$. **13.** $32\frac{1}{4}$. **14.** $51\frac{5}{8}$. **15.** $49\frac{11}{14}$.
16. $51\frac{13}{18}$. **17.** $67\frac{9}{10}$. **18.** $97\frac{23}{44}$. **19.** $84\frac{13}{18}$. **20.** $111\frac{3}{14}$. **21.** $3\frac{17}{40}$ T.
22. $\$57\frac{17}{40}$.

Page 53.—20. $\frac{13}{35}$. **21.** $\frac{27}{63}$. **22.** $\frac{2}{21}$. **23.** $\frac{7}{18}$. **24.** $\frac{1}{4}$. **25.** $\frac{1}{4}$. **26.** $\frac{1}{50}$.
27. $\frac{1}{4}$. **28.** $\frac{7}{20}$. **29.** $\frac{23}{126}$. **30.** $\frac{43}{210}$. **31.** $\frac{16}{105}$. **33.** $12\frac{1}{4}$. **34.** $17\frac{5}{12}$.
35. $21\frac{5}{13}$. **36.** $27\frac{1}{13}$. **37.** $38\frac{2}{21}$. **38.** $45\frac{1}{4}$. **Lesson 45.—2.** $30\frac{3}{11}$.
3. $1\frac{6}{13}$. **4.** $1\frac{7}{15}$. **6.** $28\frac{11}{14}$. **7.** $45\frac{3}{13}$. **8.** $58\frac{1}{4}$.

Page 54.—10. $8\frac{13}{15}$. **11.** $16\frac{1}{15}$. **12.** $5\frac{41}{44}$. **13.** $4\frac{11}{14}$. **14.** $22\frac{13}{15}$.
15. $27\frac{7}{10}$. **16.** $8\frac{1}{23}$. **17.** $8\frac{1}{41}$. **18.** $6\frac{47}{55}$. **19.** $6\frac{23}{42}$. **20.** $28\frac{1}{9}$. **21.** $64\frac{1}{13}$.
22. $50\frac{13}{18}$. **23.** $15\frac{9}{25}$. **24.** $14\frac{19}{49}$. **25.** $60\frac{42}{8}$. **26.** $46\frac{11}{14}$ bu. **27.** $31\frac{7}{12}$ yd.
28. $10\frac{21}{45}$ da. **29.** $5\frac{23}{100}$ T. **Lesson 46.—1.** $22\frac{11}{14}$. **2.** $16\frac{13}{18}$. **3.** $1\frac{17}{49}$.
4. $17\frac{7}{20}$. **5.** $9\frac{7}{12}$. **6.** $11\frac{4}{5}$. **7.** $13\frac{7}{8}$. **8.** $3\frac{1}{4}$. **9.** $24\frac{23}{48}$. **10.** $6\frac{9}{10}$. **11.** $19\frac{3}{4}$.
12. $6\frac{1}{8}$. **13.** $4\frac{17}{41}$. **14.** $7\frac{47}{80}$. **15.** $8\frac{44}{45}$. **16.** $24\frac{1}{10}$. **17.** $23\frac{47}{41}$. **18.** $3\frac{3}{32}$.

Page 55.—19. $30\frac{1}{4}$. **20.** $6\frac{1}{4}$. **21.** $24\frac{9}{20}$. **22.** $16\frac{9}{10}$. **23.** $51\frac{7}{12}$.
24. $14\frac{23}{44}$. **25.** $288\frac{5}{24}$ bu. **26.** $164\frac{9}{10}$ bu. **27.** $43\frac{11}{14}$ mi. **28.** $\$345\frac{3}{10}$.
29. $170\frac{1}{12}$ rd. **30.** $\$41\frac{1}{4}$.

Page 56.—1. 36. **2.** $109\frac{3}{28}$; $20\frac{13}{18}$; $3\frac{11}{14}$.

Page 57.—4. $\frac{102}{13}$; $\frac{153}{14}$; $\frac{122}{12}$; $\frac{711}{11}$. **5.** $11\frac{7}{8}$; $6\frac{1}{4}$; 8; $23\frac{2}{33}$. **10.** 24;
20; 147. **11.** 102. **13.** \$3.06; 70 mi.; 304 T.

Page 58.—29. $3\frac{11}{14}$. **30.** $8\frac{1}{4}$. **31.** $11\frac{1}{4}$. **32.** $5\frac{11}{14}$. **33.** $4\frac{19}{18}$. **34.** $4\frac{11}{14}$.
35. $4\frac{7}{32}$. **36.** $4\frac{24}{44}$. **37.** $2\frac{27}{47}$. **38.** $2\frac{1}{17}$. **39.** $5\frac{1}{15}$. **40.** $5\frac{7}{8}$. **41.** $1\frac{1}{4}$.
42. $6\frac{1}{4}$. **43.** $7\frac{2}{3}$. **44.** $1\frac{1}{15}$. **45.** $21\frac{1}{4}$. **46.** $6\frac{2}{3}$. **47.** $5\frac{1}{4}$. **48.** 7. **49.** $12\frac{1}{4}$.
50. $11\frac{1}{4}$. **51.** $6\frac{2}{4}$. **52.** $3\frac{2}{3}$.

Page 59.—1. $8\frac{2}{3}$. **2.** $19\frac{1}{4}$. **3.** $30\frac{2}{3}$. **4.** $2\frac{1}{4}$. **5.** $5\frac{1}{4}$. **6.** $3\frac{2}{3}$. **7.** $26\frac{1}{4}$.
8. $66\frac{13}{18}$. **10.** 200. **11.** 100. **12.** 1400. **13.** 1032. **14.** 2000. **15.** 1890.
16. 366. **17.** 2532. **18.** 1740.

Page 60.—1. $46\frac{2}{3}$ bbl. **2.** 198 cu. ft. **3.** 16 T. **4.** 171 mi. **5.** \$1.08.
6. \$1.16. **7.** \$2.74$\frac{1}{4}$. **8.** \$6.65. **9.** \$1.95. **10.** \$.45. **11.** \$2.62$\frac{1}{4}$.
13. 27. **14.** 40. **15.** $22\frac{1}{4}$. **16.** $67\frac{5}{8}$. **17.** $76\frac{1}{4}$. **18.** $11\frac{7}{10}$. **19.** $71\frac{1}{4}$.
20. 100. **21.** 120; 90; \$20.50. **22.** \$1000; 546 gal.; 984 mi.

Page 61.—2. 196. **3.** 306. **4.** 544. **5.** 1548. **6.** 552. **7.** $128\frac{1}{4}$.
8. $259\frac{7}{8}$. **9.** 406. **10.** $448\frac{7}{8}$. **11.** \$2.97. **12.** 616 lb. **13.** 58 A.

14. 48 mi. **15.** $26.40. **16.** 26 bu. **17.** 210. **18.** 9. **19.** 2¼; 1⁷⁄₁₄.
20. 37¼. **21.** 270; 270.

Page 63.—**2.** 1¼. **3.** ²¹⁄₁₀₀. **4.** ⅞. **5.** ⅘. **6.** ⅔. **7.** ¼. **8.** ⁴⁄₁₅.
9. ⅝. **10.** ¼. **11.** 1.60. **12.** .72. **13.** 55. **14.** .55. **15.** 24%.
16. 60%. **17.** $4.90. **18.** .40. **19.** ⁴⁄₁₅. **20.** ⁷⁄₁₀. **21.** 72%. **22.** 45%.

Page 64.—**23.** $24.78. **24.** ⅞. **25.** ⁴⁄₁₁. **27.** 742½ ft. **29.** 31¼ T.
30. 411 sq. ft.; 247⅛ sq. ft.; 417 sq. ft. **Lesson 55.**—**2.** 6⁹⁄₁₃; 9¹⁴⁄₁₇;
7¹⁴⁄₁₆₆; 3¹¹⁄₁₃; 12¹⅓.

Page 65.—**4.** 29⅔; 67⅚; 52¹⁄₁₂; 82¹⅓; 118⁸⁄₂₁; 55¼. **5.** $196⅞. **6.** $88.80.
7. $159.37½. **8.** $3.81¼. **9.** $.81¼. **10.** 94⅞ ft. **11.** $12.96. **12.** $6.
13. 136½ yd. **14.** $4.90. **15.** $95.60. **16.** 175¢. **17.** $316¼; $316¼.

Page 66.—**11.** 77¢. **13.** 16 A. **14.** 63 yr.

Page 68.—**10.** ⁴⁄₁₆. **11.** ²⁄₁₇. **12.** ²⁄₁₉. **13.** ⁸⁄₁₅. **15.** ⁵⁄₁₂. **16.** ⁴⁄₅₁.
17. ⁷⁄₇₂. **18.** ⁵⁄₂₃₉. **19.** ²⁄₅₁. **20.** ⁷⁄₆₃. **21.** ⁷⁄₂₁₇.

Page 69.—**2.** ⁷⁄₁₆. **3.** ⅝. **4.** ¼. **5.** ⅝. **6.** ⅙. **7.** ⅞. **8.** ⅔. **9.** ⅔.
10. ⅞. **11.** $1½. **12.** 8⅞ yd.; 104 yd. **13.** 7⅞ qt.; 39⅘ qt. **15.** 24.
16. 28. **17.** 29¼. **18.** 33¼. **19.** 69⅔. **20.** 62. **21.** 109⅘. **22.** 166¹⅔.
23. 112.

Page 70.—**2.** 1⅚. **3.** 2¼. **4.** 1¹⅚. **5.** 14⁸⁄₁₁. **6.** 7⁷⁄₁₀. **7.** 5¹⅔.
8. 5⁵⁄₂₄. **9.** 5⁵⁄₂₁. **10.** 4⅘. **12.** 2. **13.** 1⁷⁄₁₅. **14.** 1¹⅞. **15.** ⅝. **16.** ³⁴⁄₉.
17. 1⅞. **19.** 7⅕. **20.** 8⅘. **21.** 9⅛. **22.** 12. **23.** 7¼. **24.** 7⅞. **25.** 55.
26. 62.

Page 71.—**2.** 1¹⅔. **3.** 1¼. **4.** ⅝. **5.** ²⅘. **6.** 4⁵⁄₂₃. **7.** 1¹⅞.
8. 1²⅔. **9.** 2¹⅓. **10.** 1⁶¹⁄₁₂₉. **11.** 37⅓ bu.; 264⅓ bu. **12.** $2400;
$1000. **13.** 12. **14.** 10. **15.** 100 da. **16.** $58¼. **17.** $1⅞. **18.** $5.
19. 33⁴⁄₁₃ A. **20.** 33⅓%. **21.** 33⅓%.

Page 72.—**1.** 9¾ hr.

Page 73.—**2.** 2³⁷⁄₁₂₀. **3.** 1¹⁄₂₄. **4.** $.07. **5.** 743⅔ sq. ft. **6.** $9.28¼.
7. 150; 18; ⁴⁴⁄₂₆₇. **8.** $.75. **9.** $102⅘. **10.** 21⅘. **11.** 54¼. **12.** 1675.
13. 231¼. **14.** 279⅘. **15.** 813⅔. **16.** 45%. **17.** 80%. **18.** $1.50.
19. 30¼. **20.** 23⁷⁄₁₅. **21.** 6¼. **22.** $30¼. **23.** $3.73¼. **24.** $61¾.
25. 200 bu. **26.** $13⅘.

Page 75.—**14.** $4200. **15.** $22.10.

Page 76.—**14.** 33. **15.** 72⁷⁄₂₀; 96; 100; 50. **16.** $14.40. **17.** ¹⁄₁₀.

Page 78.—**2.** ⁹⁄₂₀. **3.** 1⅖. **4.** 1¹⁄₂₀. **5.** ½. **6.** ⅛. **7.** ⁹⁄₁₀₀. **8.** ¹⁄₁₁₅.
9. ¹⁄₁₀. **10.** ¹⁄₂₀₀₀. **11.** ¹⁄₄₀₀.

Page 79. — 13. $7\frac{1}{4}$. 14. $8\frac{7}{20}$. 15. $7\frac{3}{100}$. 16. $9\frac{11}{12}$. 17. $8\frac{1}{100}$.
18. $7\frac{21}{200}$. 19. $9\frac{11}{2000}$. 20. $7\frac{201}{2000}$. 22. $\frac{3}{5}$. 23. $\frac{1}{10}$. 24. $\frac{1}{12}$. 25. $\frac{1}{4}$.
26. $\frac{1}{8}$. 27. $\frac{1}{4}$. 28. $\frac{3}{8}$. 29. $\frac{5}{9}$. 30. $\frac{3}{4}$. 31. $\frac{7}{8}$. 33. $9\frac{3}{4}$. 34. $7\frac{1}{20}$.
35. $8\frac{3}{4}$. 36. $7\frac{7}{80}$. 37. $9\frac{1}{4}$. 38. $17\frac{1}{4}$. 39. $12\frac{2}{15}$. 40. $13\frac{4}{75}$.

Page 80. — 9. 35. 11. .025. 12. .525. 13. .36. 14. .648.
15. .0275. 16. .9375. 17. .404. 18. .3525. 19. .342. 20. .54.
21. $.486\frac{1}{4}$. 22. $.192\frac{4}{13}$. **Lesson 71.** — 1. .08; .78125; .265625; .03125;
.24; .1875; .056. 2. $\frac{9}{25}$; $\frac{11}{25}$; $\frac{2\frac{1}{5}}{25}$; $\frac{1}{125}$; $\frac{102}{125}$; $\frac{248}{500}$; $\frac{3}{4}$. 5. $\frac{17}{25}$; $\frac{22}{25}$; $\frac{17}{50}$;
$\frac{7}{80}$; $\frac{13}{50}$. 6. $8\frac{11}{20}$; $9\frac{21}{50}$; $6\frac{81}{100}$; $16\frac{73}{400}$; $7\frac{7}{200}$; $5\frac{67}{400}$.

Page 81. — 2. 331.65. 3. 538.8324. 4. 256.7743. · 5. 17.36525.
6. 1.029162. 7. 250.5317. 8. 6795.184409.

Page 82. — 9. $14.30\frac{3}{4}$. 10. $4.47\frac{1}{2}$. 11. $9.54\frac{1}{12}$. 12. $1279.17\frac{1}{4}$.
Lesson 73. — 2. 14.03. 3. 29.0899. 4. 121.055. 5. 144.2. 6. 1.343.
7. 8.554. 8. 12.1261. 9. .0015. 10. .10001. 11. 1.08999.
12. $7.12\frac{1}{2}$. 13. $.00\frac{1}{4}$. 14. $99.37\frac{1}{2}$. 15. $399.33\frac{1}{4}$. 16. .0435.
17. 235.1. 18. .05. 19. 6035.992706. 20. 2.0425; .1901.

Page 83. — 21. 131.671 A. 22. 17.4. 23. $111.96\frac{3}{4}$ T.

Page 84. — 7. .3224. 8. 40.227. 9. .01208. 10. .00202. 11. 849.849.
12. 64.6813. 13. .0011. 14. .0045. 15. .048375. 16. 64.8 T.
17. $126. 18. $111.9264.

Page 85. — 1. 68.35. 2. 68.35. 3. 6.3069 +. 4. .00305 +.

Page 86. — 5. 6.7814 +. 6. .0678 +. 7. 750. 8. .0044 +.
9. 30000. 10. 44.4321 +. 11. 1200. 12. 88750. 13. 3.5321 +.
14. 38.4. 15. .07957 +. 16. .04721 +. 17. .0022272. 18. .04275.
19. 12.075. 20. 25. 21. 6000. 22. 200. 23. 3.11. 24. .05. 25. 10.
26. 400. 27. $1.35. 28. 35 bu. 29. 25450 yd. 30. 5.75 da.

Page 87. — 1. $7.98. 2. $203.175. 3. $118.79\frac{1}{4}$.

Page 88. — 5. $42.986. 6. $17.178. 7. $121.406. 8. 13. 9. 27.
10. 2.25. 11. 15.75. 12. 110. 13. 1200. 14. 12000. 15. 1200.
16. 250. 17. 200. 18. $199.33\frac{1}{3}$. 19. .4. 20. 2. 21. 10000. 22. .081.
Lesson 79. — 2. $115.884. 3. $158.83. 4. $8.54. 5. $1348.

Page 89. — 7. $80. 8. $16.762. 9. $16.80.

Page 90. — 1. $17.07. 2. 7. 3. $.64; $3.44. 4. $28.22\frac{1}{2}$. 5. $121.77\frac{1}{2}$.

Page 91. — 6. $111. 7. $5.81\frac{1}{4}$. 8. $46\frac{7}{8}$. 9. $28.98. 10. $7.31\frac{1}{4}$.
11. $28.80. 12. $99. 13. $400.20. 14. $99.086. 15. $45.828.
16. $2003.11\frac{7}{8}$. **Lesson 82.** — 1. $3\frac{1}{4}$. 2. 4 lb. 10 oz. 3. 19 bu. 1 pk.
4. $44.03.

Page 92. — **5.** 16. **8.** $30.38. **9.** 160 yd. ; 120 yd. ; 144 yd. ; 128 yd. ; 64 yd. ; 60 yd. ; 72 yd. **10.** 8⅔ yd.

Page 93. — **1.** 19533.81½. **2.** 27940.75½. **3.** $259055.57⅞.

Page 94. — **4.** 428. **5.** 54. **6.** 15.2. **7.** .6. **8.** 1500. **9.** 3.136. **10.** 144. **11.** 2⅔⅓. **12.** 7⅜. **13.** 510. **14.** 51. **15.** 173. **16.** 17300. **17.** 17.3. **18.** 2.72¼. **19.** $354.77. **20.** $357. **21.** $3.09.

Page 97. — **6.** $34.20. **Lesson 87.** — **1.** $87.15⅛⅜. **2.** $21.22.

Page 98. — **4.** $36.19¼. **5.** $150.27.

Page 99. — **1.** $1518.50. **2.** $1014.233. **3.** $217.07¼.

Page 100. — **2.** $2.25½.

Page 101. — **2.** $430.765.

Page 102. — **3.** $5.15.

Page 104. — **2.** 11229 ft. **3.** 2503 in. **5.** 258 rd. 1 yd. **6.** 2 mi. 153 rd. 3½ yd. ; 1 mi. 120 rd. 1 yd. 1 ft.

Page 105. — **2.** 58 rd. 5 yd. 2 ft. 2 in. **3.** 31 mi. 103 rd. 4½ yd. 2 ft. 9 in. **Lesson 94.** — **1.** 15 rd. 11 ft. 8 in. **2.** 62 rd. 3 yd. 4 in. **3.** 30 mi. 210 rd. 4 yd. 1 ft. 4 in. **4.** 51 mi. 10 rd. 1 yd. 3 in. **5.** 87 mi. 2 yd. 2 ft.

Page 106. — **7.** 126 mi. 116 rd. 5 ft. 9 in. **8.** 200 mi. 298 rd. 1 yd. **9.** 110 mi. 85 rd. 2¼ yd. **10.** 546 mi. 244 rd. 15 ft. **11.** 840'mi. 6 rd. 1 yd. 1 in. **12.** 137 mi. 22 rd. 13 ft. 4 in. **Lesson 95.** — **2.** 7 rd. 4 yd. 1 ft. **3.** 27 yd. 1 ft. 8⁷⁄₁₁ in. **4.** 4 rd. 9 ft. 5¾ in. **5.** 7 mi. 22 rd. 15 ft. 5⅔ in. **6.** 15 mi. 266 rd. 3 yd. 3⅖ ft. **7.** 23 rd. 5 yd. 1 ft. 3¼ in. **8.** 99 in. **9.** 19 mi. 223 rd. 4 yd. 2 ft.

Page 107. — **10.** 5 rd. 2 yd. 1 ft. 6½ in. **11.** 4 rd. 3 yd. 1 in. **12.** 1 mi. 157 rd. 4 yd. 6 in. **13.** 9900. **14.** $2.628. **15.** 3 mi. 229 rd. 1¼ ft. **16.** 2 mi. 293 rd. 5 ft. 6 in.

Page 108. — **18.** 1000 ch.; 10 rd. **19.** 30 ch. 2.4 in. **20.** 7 ch. 60 li. **21.** 363 ft. **22.** 12267 sq. in. **23.** 179910 sq. ft. **24.** 100 sq. yd. **25.** ½ sq. rd. ; 4 sq. rd. ; 4 sq. rd.

Page 109. — **7.** 768984 cu. in. **8.** 47520 cu. ft. **9.** 10¾ cu. yd. **10.** 32 cd. **11.** 24 cu. yd. 6 cu. ft. 1121½ cu. in. **12.** 31 cu. yd. 17 cu. ft. 376 cu. in. **13.** 20 A. 145 sq. rd. 14 sq. yd. 2 sq. ft. 39 sq. in. **14.** 29 cd. 1 cu. ft. 724 cu. in.

Page 111. — **1.** 699 pt. **2.** 60 gal. 1 pt. **3.** 7 gal. 2 qt. 1 pt. **4.** 4 bu. 4 qt. 1⅔ pt. **5.** 365 da. **6.** $1.47. **7.** $6. **8.** 100 gal. ; 111⅓⅓ gal. **9.** $20.60. **10.** $24.

Page 112. — 8. 29545 oz. **9.** 39975 lb. **10.** 5 cwt. 60 lb. 4 oz. **11.** 4262 gr. **12.** 176 oz. 13 pwt. 1 gr. **13.** 7 lb. 4 oz. 6 pwt. 20 gr.

Page 113. — 14. $64.21½. **15.** 67.2 qt. **16.** 57¾ cu. in. **18.** 1 lb. 6 oz. 11 pwt. 17 gr. **19.** 5 T. 1556 lb. **20.** $22.80. **Lesson 101. — 11.** 10 lb. 1 ʒ 2 ☉ 7 gr.

Page 114. — 12. 5 wk. 3 da. 19 hr. 45 min. 58 sec. **14.** 56 yr. 5 mo. 12 da. **15.** 84 yr. 3 mo. **17.** 172 da. **Lesson 102. — 1.** 39 da. **2.** March 11, 1900. **3.** $23⅔. **4.** 5471 gr. **5.** 437½ gr.; 480 gr. **6.** $5.475.

Page 115. — 7. $14.40. **8.** $9.60. **9.** $12.80. **10.** 600 oz. **11.** 12 wk. 2 da. 13 hr. 58 min. 20 sec. **12.** $2⅓. **13.** 796½ sec. **14.** $3. **15.** 29545 oz. **16.** 5 cwt. 60 lb. 4 oz. **17.** $2.40. **18.** 375 lb. **19.** 1 T. 8 cwt. 90 lb. **Lesson 103. — 1.** 64 7/25 qt. **2.** $26.16. **3.** 1 gal. 1 qt. 1 pt.

Page 116. — 4. 48 bu. 1 pk. **5.** 93⅓ mi. **6.** 16 min. 6 sec. **7.** $3. **8.** 1612¼ da. **9.** 31000 sheets. **10.** $13.79. **11.** 50 yr. 3 mos. 9 da. **12.** 13 7/24 ft. **13.** 134 oz. 16 pwt. 19 gr. **14.** 35 da. **15.** 64⅘ ft. **16.** $206.55. **17.** 144 7/15 hr. **18.** $42.

Page 117. — 13. 868 d.; 2007¾ d.; 4495¼ d.; 2358.5 d. **14.** £45 9 s. 6 d. 1 far.; £177 8 s. 10 d.; £38 4 d. 1 far.; £158 2 s. 1 d. **17.** $17.01. **18.** $.30.

Page 124. — 1. 1728 sq. rd. **2.** $1500. **3.** 10½ sq. in.; 4200 sq. yd. **5.** 90 rd.

Page 125. — 1. 3456 sq. rd. **2.** $15000. **3.** 12 ft. **4.** 45 sq. ch.; 196020 sq. ft.; 720 sq. rd.; 4½ A. **5.** 30 ft. **6.** 3200 sq. rd.; 20 A. **7.** 6300 sq. ft. **8.** 3000 sq. rd. **9.** 1526 sq. ft.; 735 sq. ft. **10.** $50.24⅘.

Page 128. — 1. 4400 sq. ft.

Page 129. — 2. 130 sq. ft. **3.** 5625 sq. yd. **4.** 8750 sq. rd.; 54 11/16 A. **5.** $69.37½. **6.** 3½ ft. **7.** 28 ft. **8.** 49½ ft. **9.** 8 strips. **10.** 58⅞ yd. **Lesson 115. — 1.** 48 sq. yd.

Page 130. — 4. 30 rd.; 2400 sq. rd. **5.** 118 sq. yd. **6.** $32.67. **10.** 9 in. **11.** $3102.72. **13.** 4500 sq. ft.

Page 131. — 3. 25⅕ in.; 37⅘ in.; 75⅘ ft.; 62⅘ yd.; 37⅘ rd. **4.** 18⅘ in.; 31⅘ in.; 15⅘ yd.; 11 rd. **6.** 14 in.; 21 ft.; 28.7 yd.; 3514 rd. **7.** 51⅘ rd. **8.** 6 ft.

Page 132. — 1. 28⅘ sq. in.; 78⅘ sq. in.; 201⅓ sq. in.; 95 7/16 sq. ft.; 122 4/9 sq. rd. **2.** 78⅘ sq. in.; 154 sq. ft.; 616 sq. yd.; 221.76 sq. rd.

Page 133. — 3. 132 ft. **4.** 1257⅓ sq. ft. **5.** 2036 4/7 sq. rd.

Page 137. — 12. 24. **Lesson 121. — 1.** The first, 4 times as much as the second. **2.** 2 cu. ft. 534 cu. in. **3.** 29 cu. yd. 17 cu. ft. **4.** 1 gal. **5.** 8 gal. **6.** 1620.

Page 138. — **7.** 240 cu. in.; 248 sq. in. **Lesson 122.** — **2.** 512 cu. ft.; 32 cd. ft.; 4 cd. **3.** 9¼ cd.; $38.

Page 139. — **4.** 36 cd.; $162. **5.** 96 cu. yd.; $28.80.

Page 140. — **10.** 20 bd. ft.; 37½ bd. ft. **11.** 8 cd.; $44.80. **12.** 192 bd. ft. **13.** 450 bd. ft. **14.** 16⅞ cd.

Page 143. — **15.** $108; $90; $99. **16.** $56.25; $87.50; $50.62½. **18.** $4.50; $3.37½; $3.75. **19.** $10.62½. **20.** $37.50; $45. **21.** $83.33⅓; $100. **Lesson 126.** — **2.** $460. **3.** $747.50.

Page 144. — **4.** $399. **5.** $228. **6.** $675. **7.** $854. **10.** $69.60. **11.** $55.90. **12.** $77.25. **13.** $104.40. **14.** $123.08.

Page 145. — **1.** 40 bd. ft. **2.** 8 A. **3.** $594. **4.** $19. **10.** 2.075. **11.** 12.857½. **12.** 4 sq. yd. **13.** 72 sq. ft. **14.** 5. **15.** 8 strips; 48 yd. **16.** $.84.

Page 146. — **2.** 1¼ cu. ft. **3.** 22½ lb. **4.** 125 lb. **12.** 314⅞ sq. ft. **13.** $.50.

Page 147. — **1.** 278 gi. **2.** $61½. **3.** 42 da. **4.** 260. **5.** 398¼. **6.** $22. **7.** 51.1 bd. ft. **8.** 750; .0000351. **9.** $475. **11.** $148.50. **12.** 18 ft.

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